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MARKETING DEPARTMENT

ENVIRONMENTAL ENGINEERING

G. D. GIBSON
SENIOR ENVIRONMENTAL ENGINEER

May 29, 1990

Exxon RAS 7-0104
1725 Park Street
Alameda, California

May 1990

Mr. Ariu Levy
Alameda County Enviromental Health Department
Hazardous Materials Division
80 Swan Way, Suite 200
Oakland, California 94621

Dear Mr. Levy:

Attached for your review and comment is a report by Harding Lawson Associates of Novato, California on a Phase III Ground-Water Investigation at the above referenced site in the City of Alameda. This work was performed between January and March 1990. Based on the data presented in this report we will be proposing a two-phase remediation program. As an interim remediation method, and to gain hydraulic control at the site, we will be installing a minimum of 3 recovery wells along the down-gradient property lines. We are currently evaluating several different methods to pump and treat the groundwater. A final remediation method addressing hydrocarbons in both the soil and groundwater will be proposed after the interim remediation program is shown to be effective.

Should you have any questions or concerns after your review, please contact me at (415) 246-8768. We will be proceeding with this work. Thank you.

Sincerely,

Gary D. Gibson

GDG:vv
1103E
Attachment

c - w/attachment:
Mr. L. Feldman - San Francisco Bay Region Water Quality Control Board

w/o attachment:
Mr. J. R. Hastings
Mr. J. K. Hunter
Mr. L. W. Lindeen
Mr. M. Thomson - Alameda County District Attorney's Office
Ms. S. M. Watson - Harding Lawson Associates

A Report Prepared for

Exxon Company USA
P. O. Box 4032
Concord, California 94524

PHASE III EVALUATION OF PETROLEUM HYDROCARBONS
EXXON STATION #7-0104
1725 PARK STREET
ALAMEDA, CALIFORNIA

HLA Job No. 04167,309.02

by

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May 1, 1990

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1.0 INTRODUCTION

This report presents the results of Harding Lawson Associates' (HLA) Phase III evaluation of petroleum hydrocarbons at Exxon Station #7-0104, 1725 Park Street, Alameda, California (site).

The purpose of this investigation has been to:

1) Further evaluate the areal extent of petroleum hydrocarbons detected in soil and groundwater at the site;

2) Obtain hydraulic parameters of the uppermost groundwater zone at the site;

3) Evaluate organic and inorganic parameters of groundwater quality at the site; and

4) Develop recommendations to address onsite soil and groundwater remediation activities.

HLA's scope of services was authorized by Change Order #1 of Contract Number 88946914 and was performed in accordance with HLA's Work Plan dated January 17, 1990.

2.0 BACKGROUND

The project site is in Alameda, California, approximately 0.5 mile south/southwest of U.S. Interstate 880. San Francisco Bay is approximately 1.5 miles southwest of the site and Alameda Harbor Tidal Canal is approximately 0.25 mile north/northeast of the site. The surrounding topography is relatively flat with the surface elevation of the site approximately 17 feet above mean sea level.

2.1 Site Description and Background

Exxon Station #7-0104 is located at the western corner of Park Street and Eagle Avenue (Plate 1). Land use in the area is commercial and residential. Structures at the site include a building with a convenience store and cashier's booth, two multi-pump fuel dispenser islands and three underground storage tanks (USTs).

The site was formerly occupied by a Regal Service Station owned by Wickland Oil Company, Sacramento, California. In 1986, the station was remodeled and three underground storage tanks were removed and replaced with three double-walled fiberglass tanks. The tanks were used to store regular, unleaded, and premium unleaded gasoline. No information regarding the sampling of soil and/or groundwater at the time of tank removal could be obtained by HLA.

A Sensitive Receptor-Risk Assessment Survey for the site was prepared by Engineering Science and Technology, Inc. (EA), in May 1988. The EA study identified five monitoring wells, an industrial water well, and an irrigation well within 0.5 mile of the site.

2.2 Previous HLA Investigations

As part of a property transfer assessment, HLA was retained by Exxon to perform a Phase I evaluation of petroleum hydrocarbons at the site. The results of

HLA's evaluation were submitted to Exxon in a letter report dated June 24, 1988. During HLA's Phase I evaluation, three monitoring wells (MW-1 through MW-3) were installed at the site (Plate 2). Review of laboratory results for soil samples collected at the site indicates that total petroleum hydrocarbons (TPH) calibrated as gasoline were present in concentrations ranging from 11 milligrams per kilogram (mg/kg) to 1,400 mg/kg (Table 1). Groundwater samples were also collected from each of the wells at the site and analyzed for TPH calibrated as gasoline, and for benzene, toluene, ethylbenzene, and xylenes (BTEX). A maximum concentration of 110 milligrams per liter (mg/l) TPH as gasoline was detected in Monitoring Well MW-2, located downgradient of the tank field (Table 2). Review of laboratory analytical results for water samples from Well MW-1, located upgradient of the tanks and pump islands, showed TPH (gasoline) at a concentration of 27 mg/l.

On the basis of the results obtained during our Phase I investigation, HLA performed a Phase II investigation to further evaluate the extent of petroleum hydrocarbons present in soil and groundwater at the site. The results of the Phase II investigation were presented to Exxon in a report titled *Phase II Evaluation of Petroleum Hydrocarbons, Exxon Service Station R/S #7-0104, 1725 Park Street, Alameda, California*, dated March 21, 1989. As part of that investigation, HLA installed three additional monitoring wells at the site, MW-4 through MW-6 (Plate 2). Well completion details for Monitoring Wells MW-1 through MW-6 are included with their respective boring logs in Appendix A.

Review of laboratory analytical results of soil samples collected from MW-4 through MW-6 indicates that TPH (gasoline) was present in concentrations ranging from 0.6 mg/kg in Boring MW-4 to 490 mg/kg in Boring MW-6. Groundwater samples

were collected from all six wells on January 17 and 18, 1989. Analytical results showed concentrations of TPH (gasoline) ranging from 5.3 to 38 mg/l (Table 2). The highest concentrations were detected in groundwater samples collected from Wells MW-6, located adjacent to the tank field, and MW-2, located downgradient of the tank field.

2.3 Regional Geology And Hydrogeology

The site is located on the island of Alameda at the eastern edge of San Francisco Bay. The uppermost geologic unit in the area consists of fill generally comprised of gravelly clays and clayey gravels that extend to an approximate depth of 5 feet below ground surface (bgs). The fill is underlain by Quaternary age sands, silts, silty and clayey sands, and sandy clays comprising the Merritt Sand and Posey formations. The Merritt Sand blankets the Posey Formation but the units are similar in composition and are therefore commonly grouped together. These sediments extend to an approximate depth of 30 to 40 feet bgs and comprise the uppermost aquifer in the area of the site.

The Merritt Sand and Posey formations are underlain by the Quaternary age San Antonio Formation. The San Antonio Formation consists predominantly of silty clay with occasional thin lenses of fine gravel. The silty clay serves as a confining layer for the overlying aquifer and extends to an estimated depth of 120 feet bgs. The San Antonio Formation overlies the Quaternary age sand, sandy clay, clay, and gravel of the Alameda Formation. The Alameda Formation is a water-bearing unit from 10 to 200 feet thick. The depth of this unit in the area of the site is unknown.

The Franciscan Formation underlies the Alameda Formation and consists of tectonically altered graywacke, siltstone, shale, and volcanics. The Franciscan Formation can be over 50,000 feet thick, although the depth to bedrock and its thickness in the area of the site is not known.

3.0 FIELD INVESTIGATION

HLA's field investigation was conducted between January 4 and March 19, 1990. The scope of services included drilling and 7 shallow soil borings and 1 deep soil boring and collecting soil samples from them for chemical analysis; installing and developing one groundwater monitoring well in the deeper boring and collecting a groundwater sample from it; conducting a series of aquifer slug tests; measuring water levels; and arranging a survey to provide reference elevations at each monitoring well location.

3.1 Soil Sampling Program

To further evaluate the areal and vertical distribution of TPH and BTEX concentrations in soil of the vadose zone, Soil Borings MW-7 and SB-1 through SB-7 were drilled at the locations shown on Plate 2. Soil samples were collected from each boring and 17 samples were submitted for chemical analysis.

Drilling was performed on January 4 and March 19, 1990, by Gregg Drilling, Concord, California, using a truck-mounted drill rig equipped with 6-inch diameter hollow-stem augers. An HLA geologist under the supervision of a California-registered geologist was present during drilling operations to coordinate activities, perform health and safety monitoring, collect soil samples, and record subsurface conditions. The soils were classified according to the Unified Soil Classification System (USCS). The lithologic logs of the soil borings and a key to the USCS are presented in Appendix A.

Relatively undisturbed soil samples were collected for chemical analysis from the borings at depths between approximately 2.0 and 6.0 feet bgs. In addition, samples were collected from MW-7 every 5 feet to an approximate depth of 40 feet bgs for lithologic description and screening. A Century flame ionization organic vapor analyzer (OVA) was used to screen soil samples for the presence of volatile organic compounds. Samples

were also checked for soil discoloration, petroleum and chemical odors, and the presence of liquid phase chemicals. Following sample collection and field screening, soil samples selected for chemical analysis were sealed with aluminum foil-lined plastic caps, taped, labeled, and stored on blue ice until delivery to NET Pacific, Inc., Santa Rosa, California. NET is a state-certified laboratory. Chain of custody records were initiated in the field and maintained until samples were relinquished to the analytical laboratory.

To help prevent potential cross contamination, downhole equipment was steam cleaned prior to use. Soil sampling equipment was also cleaned with an Alconox wash and deionized water rinse prior to the collection of each soil sample. Soil sampling procedures were conducted in accordance with HLA QA/QC procedures, which meet or exceed all state and local requirements.

3.2 Monitoring Well Installation and Development

Following soil sample collection, the 6-inch diameter augers were removed from Boring MW-7. Subsequently, native sands caved in the borehole. Boring MW-7 was then overdrilled using 11-inch diameter hollow-stem augers to an approximate depth of 20 feet bgs. Boring MW-7 was converted to a monitoring well by installing flush-threaded 4-inch-diameter, Schedule 40 PVC well casing and screen. Prior to removal of the auger sections, factory-slotted 0.020-inch well screen with a bottom cap was placed in the boring. The well screen was installed from approximately 4 to 19 feet bgs. The casing was then extended to within approximately 0.5 foot of the ground surface. The annular space between the well screen and the borehole wall was backfilled with Lonestar #3 sand to approximately 0.5 foot above the top of the well screen. A 0.5-foot-thick bentonite pellet seal was placed on top of the sand pack and hydrated with fresh water. The remaining annular space to ground surface was filled with a

bentonite-cement sanitary seal. As the annular materials were placed inside the hollow-stem augers, the augers were lifted out of the borehole. This method minimized the caving of native soils in the walls of the borehole. The monitoring well was completed below grade with a locking cap and watertight flush-mounted well cover. Well completion details for Monitoring Well MW-7 are included with the boring log on Plate A-7.

After Monitoring Well MW-7 was installed, it was developed on January 8, 1990, by pumping with a centrifugal pump. Downhole equipment was steam cleaned before use. Development was continued until the water removed from the well contained few fine-grained sediments, as judged by the clarity of the purged water.

On January 19, 1990, the top of each monitoring well casing was surveyed by Moran Engineering, a registered land surveyor. Surveying was performed to obtain elevations relative to mean sea level datum for water-level elevation and data correlation.

3.3 Groundwater Sampling Program

Groundwater samples were collected from MW-1 through MW-6 on December 11, 1989, as part of the existing quarterly sampling program. On January 9, 1990, water-level measurements were obtained from all wells onsite using an oil/water interface probe, and groundwater samples were collected from Monitoring Well MW-7. Additionally, groundwater samples for inorganic chemical analysis were collected from Wells MW-1 and MW-4 on March 7, 1990.

All wells were purged a minimum of three well volumes by pumping prior to sampling. Water quality parameters (pH, electrical conductivity, temperature, and clarity) were also monitored during purging of the wells. The purged water was contained in 55-gallon drums and stored at the site. Groundwater samples were

collected using a stainless steel bailer and decanted into 40-milliliter (ml) vials and 1 liter glass bottles.

Following collection, groundwater samples were stored on blue ice until delivery to NET for chemical analysis. Chain of custody records were initiated in the field and maintained until samples were relinquished to the laboratory. Water-level and sampling equipment was steam cleaned before use to minimize cross contamination.

3.4 Analytical Program

Soil and groundwater samples submitted for chemical analysis on January 4 and 9, and March 19, 1990, were analyzed for TPH calibrated as gasoline by EPA Test Method 8015 (modified) and for BTEX by EPA Test Method 8020 using purge and trap extraction by EPA Test Method 5030. Groundwater samples collected from Well MW-1 and MW-4 on March 7, 1990, were analyzed for general minerals. All samples were analyzed by NET.

3.5 Slug Testing Program

On February 13, 1990, a series of slug tests was performed in Monitoring Wells MW-1, MW-2, MW-6, and MW-7 to estimate the hydraulic conductivity and transmissivity of the uppermost aquifer zone that underlies the site. The slug tests were performed in accordance with a method presented by Bouwer and Rice *(1976)* and Bouwer (*1989*) for determining the hydraulic conductivity and transmissivity of unconfined aquifers with completely or partially penetrating wells.

The hydraulic conductivity and transmissivity of the uppermost aquifer zone in the vicinity of each well tested was calculated from the rate of rise of the water level in the well after a volume of water was suddenly removed. Simulation of water removal

during the subject tests was achieved by completely submerging a weighted 5-foot-long PVC slug (with a displacement volume of 0.109 cubic foot), allowing the water level in the well to reach equilibrium, and then quickly removing the slug. Water-level changes were measured using an In-Situ Inc. pressure transducer placed near the bottom of the well, and Hermit model SE1000B data logger. Prior to the beginning and end of each slug test, calibration of the pressure transducer was checked using a steel measuring tape.

4.0 RESULTS OF FIELD INVESTIGATION

4.1 Soil and Groundwater Conditions

Lithologic data obtained during previous drilling at the site revealed a general sequence of 1.5 to 5 feet of clayey gravel overlying interbedded sand, silty sand, clayey sand, and silt to an approximate depth of 20 feet bgs. The boring for Well MW-7 encountered pea gravel from 0.5 to 2.5 feet bgs. The well is located near the underground storage tanks (USTs) and the pea gravel is presumed to be backfill material for UST product lines. In the boring for Well MW-7, sandy clay was encountered from 19.5 to 20.5 feet bgs. Interbedded silty sand, sandy silt, and sand was encountered from depths of 20.5 to 37.5 feet bgs. These sediments are part of the Merritt Sand and Posey formations and comprise the uppermost aquifer at the site. Clayey sand was encountered from 37.5 to 40 feet bgs and may represent the top of the confining clay of the San Antonio Formation. Saturated soils were first encountered at depths ranging from approximately 7 to 8 feet bgs. On the basis of site conditions and our review of boring logs from water wells within several hundred feet of the site, the vertical extent of the uppermost aquifer appears to range from 35 to 40 feet bgs.

Water-level measurements from Monitoring Wells MW-1 through MW-3 have been obtained on nine dates between June 10, 1988, and February 13, 1990. Additionally, eight water-level measurements have been obtained from Wells MW-4 through MW-6 from January 17, 1989, to February 13, 1990; and one water-level measurement has been obtained from MW-7 on February 13, 1990. Water-level and product thickness measurements are presented in Table 3. The depth to water measurements were used to calculate groundwater elevations in feet above mean sea level. Groundwater elevations from February 13, 1990, have been used to construct the potentiometric contour map presented on Plate 3. As shown, the localized direction of

groundwater flow is toward the east. The hydraulic gradient across the site ranges from approximately 0.02 to 0.03 foot/foot.

4.2 Slug Test Results

Water-level data from the slug tests performed in Monitoring Wells MW-1, MW-2, and MW-6 are illustrated as semilog plots of the change in water level versus time on Plates B1 through B5 (Appendix B). These data were analyzed to derive values of hydraulic conductivity and transmissivity for the uppermost aquifer zone at the site according to the method of Bouwer and Rice (*1976*) and Bouwer (*1989*). The test data from Well MW-7 have not been presented due to an unrepresentative response observed in the well suggesting a hydraulic connection with backfill pea gravel in the vicinity of nearby UST lines.

Analysis of the slug test data was based upon the saturated thickness of the uppermost aquifer (approximately 29 feet) to derive hydraulic parameters. Calculation sheets of the analyses are presented in Appendix B. The effect of the rate of rise of the water level in each well attributed to drainage of the gravel pack was eliminated by ignoring the early data points of the semilog plots and using the second straight line portion in the data plot for the calculation of aquifer parameters. The porosity of the gravel pack used in deriving hydraulic conductivity was calculated using the first straight line portion in the data plot.

A summary of the slug test results is presented in Table 4. Analysis of the semilog plots resulted in hydraulic conductivity and transmissivity values that ranged from 0.49 to 1.04 feet per day (ft/day), and 14 to 30 square feet per day (ft^2/day), respectively. The geometric mean hydraulic conductivity and transmissivity values of

0.76 ft/day and 22 ft^2/day, respectively, are considered representative of the silty sand materials of the uppermost aquifer zone at the site.

On the basis of hydraulic gradients across the site (0.02 to 0.03 ft/ft), the geometric mean hydraulic conductivity value obtained from the slug tests, and an estimated effective porosity of 30 percent for the silty sand materials that comprise the uppermost aquifer zone, the horizontal velocity of groundwater flow in the uppermost aquifer zone ranges from about 0.05 to 0.08 ft/day.

4.3 Soil Sampling Results

The laboratory analytical reports of soil samples collected from Borings MW-7 and SB-1 through SB-7 are presented in Appendix C, and Table 1 presents a summary of the chemical results. Laboratory results indicate that the soil sample collected at 5.5 feet bgs from MW-7 contained 600 mg/kg TPH (gasoline) and BTEX concentrations of 1,700; 3,200; 10,000; and 29,000 µg/kg, respectively. The soil samples collected from Borings SB-1 through SB-7 at depths from 2 to 6 feet bgs ranged in TPH concentrations from nondetect (ND) to 2,600 mg/kg. The highest TPH concentration was detected in the 5.0 foot sample from Boring SB-1 (2600 mg/kg). BTEX constituents detected in Borings SB-1 through SB-7 ranged in concentration from ND to 6,900 µg/kg, ND to 23,000 µg/kg, ND to 32,000 µg/kg, and ND to 44,000 µg/kg, respectively. The highest concentrations of BTEX were detected in the 5-foot sample of SB-1 and in the 5.5-foot sample of SB-3.

4.4 Groundwater Sampling Results

The laboratory analytical reports for groundwater samples collected from Monitoring Wells MW-1, MW-4, and MW-7 are presented in Appendix C. Table 2

presents a summary of the chemical parameters and concentrations detected in samples collected from each monitoring well throughout the subsurface investigation.

Chemical results of the January 9, 1990, groundwater sampling event from Monitoring Well MW-7 indicate that TPH as gasoline was detected in the groundwater sample at a concentration of 17 mg/l. Benzene, toluene, ethylbenzene, and xylene were detected in the groundwater at concentrations of 380, 180, 330, and 1,300 μg/l, respectively. The detected concentrations of benzene, toluene, and xylenes exceed the California Department of Health Services drinking water action levels of 0.7, 100, and 620 μg/l, respectively.

Chemical results of the March 7, 1990, groundwater sampling event from Monitoring Wells MW-1 and MW-4 indicate that total dissolved solid (TDS) were detected at concentrations of 910 and 370 mg/l, respectively.

5.0 DISCUSSION OF CHEMICAL RESULTS

5.1 Soil Chemical Conditions

Chemical results for soil samples collected from borings drilled at the site during the present and former investigations indicate that elevated concentrations of TPH (as gasoline) and BTEX have been detected between 2 and 10 feet bgs. The concentrations of TPH detected in the soil samples collected between the depths of 2 and 10 feet bgs range from 0.6 to 2,600 mg/kg. Plate 4 presents the distribution of TPH concentrations detected in the soil borings drilled at the site.

Similarly, concentrations of BTEX constituents detected in soil samples have ranged from: ND to 6,900 μg/kg; ND to 32,000 μg/kg; ND to 32,000 μg/kg; and ND to 150,000 μg/kg, respectively (Table 1). Because of the shallow depth to groundwater at the site, it appears that chemical-bearing soil identified in the vadose zone may be the result of chemical transport due to fluctuating groundwater levels.

In general, California state regulatory agencies currently classify soils containing TPH as hazardous waste if the concentrations are greater than 1,000 mg/kg, as designated waste if concentrations are between 100 and 1,000 mg/kg, and as nonhazardous if concentrations are less than 100 mg/kg. On the basis of these guidelines solely, the soils in the vicinity of MW-2, MW-6, MW-7, SB-1, SB-2, SB-3, SB-5, SB-6, and SB-7 primarily between the depths of 4 to 6 feet would be classified as hazardous or designated wastes.

5.2 Groundwater Chemical Conditions

Chemical results for groundwater samples collected from monitoring wells at the site indicate that TPH and BTEX contamination occurs across most of the site. The distribution of benzene concentrations from the most recent sampling event of

December 11, 1989 (January 9, 1990 for MW-7) is shown on Plate 5. The concentrations of benzene detected in groundwater samples collected at the site ranged from 200 µg/l to 1,100 µg/l and exceed the California Department of Health Services (DHS) action level of 0.7 µg/l (Table 2) established to protect drinking water. Additionally, the concentrations of toluene and xylenes detected in Wells MW-2, MW-3, MW-4, MW-5, MW-6, and MW-7 also exceeded the DHS action levels established for these parameters during the December sampling event (Table 2).

The concentrations of TDS in groundwater samples collected beneath the site indicate that the groundwater is potentially suitable for municipal or domestic water supply. The State Water Resources Control Board Resolution No. 88-63, *Sources of Drinking Water*, states that groundwater with less than 3,000 mg/l TDS is considered potentially suitable for a municipal or domestic water source.

6.0 REFERENCES

Bouwer, H., 1989. *The Bouwer and Rice Slug Test - An Update*, Ground Water, Vol. 27, No. 3, May-June.

Bouwer, H. and Rice, R.C., 1976. *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*, Water Resources Research, Vol. 12, No. 3, June.

Table 1. Summary of Chemical Results of Soil Sample Analyses

Boring/ Well No.	Sampling Date	Depth (feet)	TPH (gasoline) mg/kg[1]	Benzene µg/kg[2]	Toluene µg/kg	Ethyl-Benzene µg/kg	Xylenes µg/kg
MW-1	06/02/88	10.0	11.0	670	ND(25)	150	370
MW-2	06/02/88	5.0	1,400	ND(2,000)[3]	32,000	25,000	150,000
MW-3	06/02/88	5.0	74	ND(500)	ND(500)	ND(500)	2,400
MW-4	01/09/89	5.0	0.6	17	2	7	12
MW-5	01/09/89	4.5	2.0	55	7	66	240
MW-6	01/09/89	5.0	490	3,700	970	23,000	94,000
MW-7	01/04/90	5.5	600	1,700	3,200	10,000	29,000
SB-1	3/19/90	2	1.8	6.2	ND(2.5)	16	9.2
SB-1	3/19/90	4.5	260	1,300	1,300	1,400	4,900
SB-1	3/19/90	5	2,600	6,900	23,000	32,000	14,000
SB-2	3/19/90	2.5	1.3	13	18	10	54
SB-2	3/19/90	4	230	1,200	3,700	2,100	1,300
SB-3	3/19/90	3	1.8	6.8	47	11	230
SB-3	3/19/90	5	540	4,600	12,000	3,200	44,000
SB-4	3/19/90	4	ND(1)	ND(2.5)	ND(2.5)	5.3	18
SB-4	3/19/90	5	ND(1)	ND(2.5)	ND(2.5)	ND(2.5)	ND(2.5)
SB-5	3/19/90	2.5	ND(1)	28	6.0	6.5	16
SB-5	3/19/90	4.5	ND(1)	150	80	16	69
SB-5	3/19/90	5.5	260	1,300	6,500	4,000	24,000
SB-6	3/19/90	2.5	140	1,100	1,200	1,700	6,700
SB-6	3/19/90	5	1.6	65	20	19	60
SB-7	3/19/90	3	240	260	1,400	1,200	4,700
SB-7	3/19/90	6	ND(1)	55	4.1	12	11

1 mg/kg: milligrams per kilogram (part per million)

2 µg/kg: micrograms per kilogram (parts per billion)

3 ND(2000): not detected at indicated detection limit

Table 2. Summary of Chemical Results of Groundwater Sample Analyses

Well Number	Date	TPH Gasoline mg/l[1]	Benzene µg/l[2]	Toluene µg/l	Ethyl-benzene µg/l	Xylenes µg/l	Total Dissolved Solids mg/l
DHS Action Levels			0.7	100	680	620	
MW-1	06/07/88	27	5,000	77	1,100	2,700	NT[3]
MW-1	01/17/89	6.8	2,000	91	800	1,600	NT
MW-1	06/01/89	1.7	170	6.9	13	230	NT
MW-1	09/18/89	2.1	9.0	53	18	130	NT
MW-1	12/11/89	5.8	200	42	290	330	NT
MW-1	03/07/90	NT	NT	NT	NT	NT	910
MW-2	06/07/88	110	12,000	12,000	2,100	12,000	NT
MW-2	01/17/89	30	6,600	3,300	1,600	7,700	NT
MW-2	06/01/89	8.7	330	280	680	1,200	NT
MW-2	09/18/89	17	580	280	570	220	NT
MW-2	12/11/89	32	1,000	850	310	1,200	NT
MW-3	06/07/88	28	6,000	80	940	1,900	NT
MW-3	01/17/89	5.3	2,500	230	590	1,100	NT
MW-3	06/01/89	5.4	330	300	570	680	NT
MW-3	09/18/89	12	680	170	350	860	NT
MW-3	12/11/89	14	1,100	150	670	690	NT
MW-4	01/17/89	19	1,000	1,500	360	2,200	NT
MW-4	06/01/89	3.6	180	240	63	810	NT
MW-4	09/18/89	6.0	290	200	28	510	NT
MW-4	12/11/89	13	750	910	510	1,200	NT
MW-4	03/07/90	NT	NT	NT	NT	NT	370
MW-5	01/17/89	26	8,700	3,900	990	5,900	NT
MW-5	06/01/89	5.2	240	220	130	690	NT
MW-5	09/18/89	8.0	340	150	140	460	NT
MW-5	12/11/89	15	720	320	450	870	NT

Table 2. Summary of Chemical Results
Groundwater Samples (continued)

Well Number	Date	TPH Gasoline mg/l[1]	Benzene µg/l[2]	Toluene µg/l	Ethyl-benzene µg/l	Xylenes µg/l	Total Dissolved Solids mg/l
DHS Action Levels			0.7	100	680	620	
MW-6	01/17/89	38	7,400	9,300	2,000	9,900	NT
MW-6	06/01/89	23	1,900	2,500	2,000	6,000	NT
MW-6	09/18/89	17	650	410	650	320	NT
MW-6	12/11/89	29	1,100	810	330	1,500	NT
MW-7	01/09/90	17	380	180	330	1,300	NT
Field Blank	12/11/89	<50	0.88	0.95	0.62	1.7	NT

1 mg/l: milligrams per liter (parts per million)

2 µg/l: micrograms per liter (parts per billion)

3 NT: Not tested

Table 3. Groundwater Elevations and Product Thickness Measurements

Well Number	Elevation Top of Well Casing[1]	Date	Depth to Water BTOC[2] (feet)	Depth to Product BTOC (feet)	Product Thickness (feet)	Potentiometric Surface Elevation (feet above MSL)
MW-1	17.35	06-10-88	6.35	NP[3]	NP	11.00
		01-17-89	5.81	NP	NP	11.54
		01-24-89	5.16	NP	NP	12.19
		06-01-89	6.27	NP	Sheen	11.08
		09-18-89	7.11	NP	NP	10.24
		10-20-89	7.28	NP	NP	10.07
		11-22-89	7.02	NP	NP	10.33
		12-11-89	6.60	NP	NP	10.75
		02-13-90	6.02	NP	NP	11.33
MW-2	16.67	06-10-88	6.20	NP	NP	10.47
		01-17-89	5.96	NP	NP	10.71
		01-24-89	5.04	NP	NP	11.63
		06-01-89	6.32	NP	Sheen	10.35
		09-18-89	6.73	NP	NP	9.94
		10-20-89	6.87	NP	NP	9.80
		11-22-89	6.80	NP	NP	9.87
		12-11-89	6.57	NP	NP	10.10
		02-13-90	6.12	NP	NP	10.55
MW-3	17.11	06-10-88	6.05	NP	NP	11.06
		01-17-89	5.49	NP	NP	11.62
		01-24-89	5.38	NP	NP	11.73
		06-01-89	5.96	NP	NP	11.15
		09-18-89	6.65	NP	NP	10.46
		10-20-89	6.88	NP	NP	10.23
		11-22-89	6.74	NP	NP	10.37
		12-11-89	6.37	NP	NP	10.74
		02-13-90	5.58	NP	NP	11.53
MW-4	17.34	01-17-89	5.36	NP	NP	11.98
		01-24-89	5.46	NP	NP	11.88
		06-01-89	6.01	NP	NP	11.33
		09-18-89	6.80	NP	NP	10.54
		10-20-89	7.08	NP	NP	10.26
		11-22-89	6.82	NP	NP	10.52
		12-11-89	6.37	NP	NP	10.97
		02-13-90	5.49	NP	NP	11.85

Table 3. Groundwater Elevations and Product Thickness Measurements (continued)

Well Number	Elevation Top of Well Casing[1]	Date	Depth to Water BTOC[2] (feet)	Depth to Product BTOC (feet)	Product Thickness (feet)	Potentiometric Surface Elevation (feet above MSL)
MW-5	16.71	01-17-89	5.39	NP	NP	11.32
		01-24-89	5.51	NP	NP	11.20
		06-01-89	5.83	NP	Sheen	10.88
		09-18-89	6.52	NP	NP	10.19
		10-20-89	6.72	NP	NP	9.99
		11-22-89	6.54	NP	NP	10.17
		12-11-89	6.21	NP	NP	10.50
		02-13-90	5.60	NP	NP	11.11
MW-6	17.56	01-17-89	5.59	NP	NP	11.97
		01-24-89	5.27	NP	NP	12.29
		06-01-89	6.25	NP	Sheen	11.31
		09-18-89	6.95	NP	NP	10.61
		10-20-89	7.24	NP	NP	10.32
		11-22-89	7.05	NP	NP	10.51
		12-11-89	6.63	NP	NP	10.93
		02-13-90	5.70	NP	NP	11.86
MW-7	17.12	02-13-90	4.98	NP	NP	12.14

1 Elevations surveyed to mean sea level.

2 BTOC - Below top of casing.

3 NP: No product.

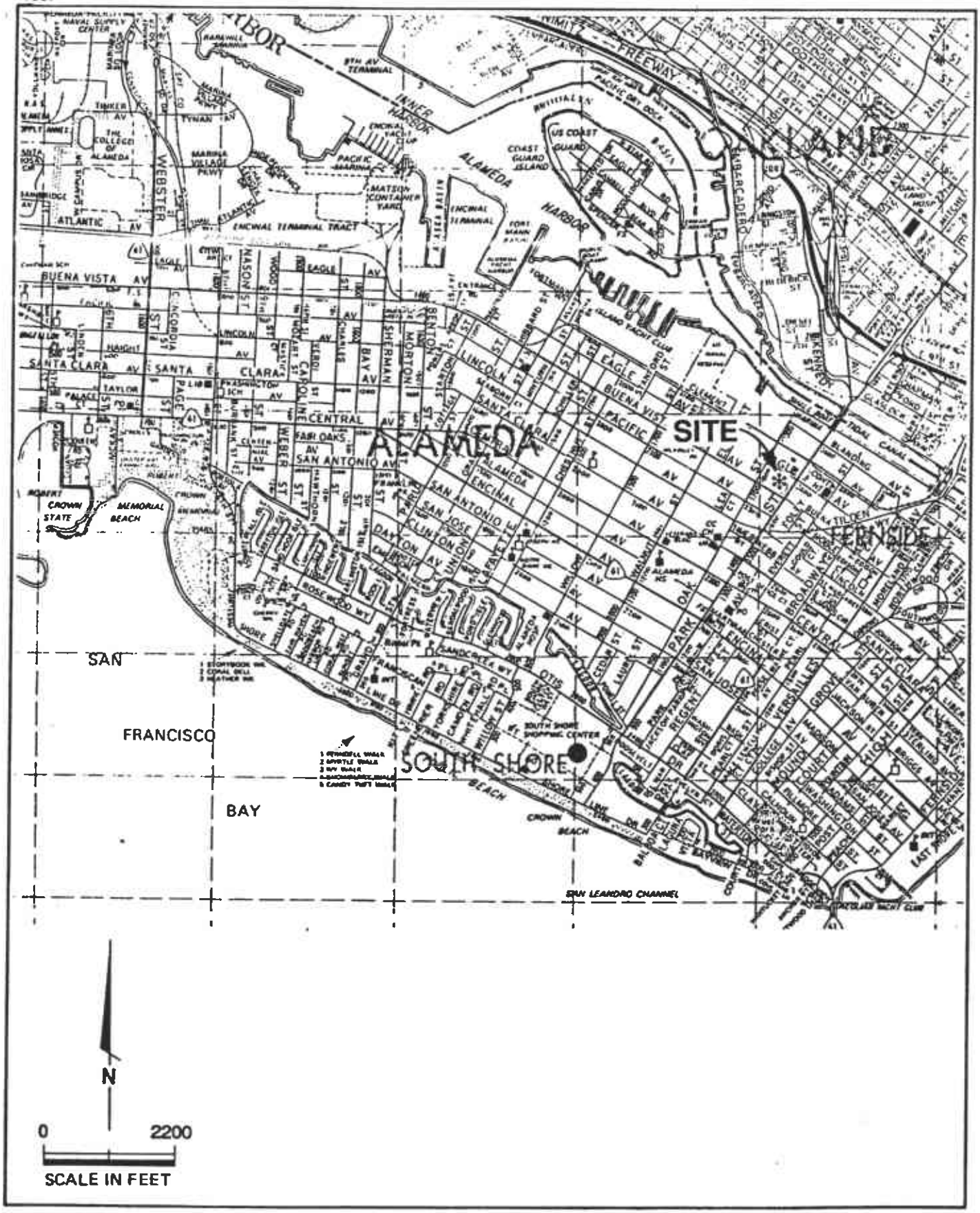
1 Elevations surveyed to mean sea level.

2 BTOC - Below top of casing.

Table 4. Summary of Slug Test Results

Well No.	Saturated Thickness (feet)	Hydraulic Conductivity (ft/day)	Transmissivity (ft^2/day)
MW-1	28.7	0.49	14
MW-2 Test 1	28.7	0.86	25
MW-2 Test 2	28.7	1.04	30
MW-6 Test 1	28.9	0.95	27
MW-6 Test 2	28.9	0.95	27
Geometric Mean	28.7	0.76	22

17387

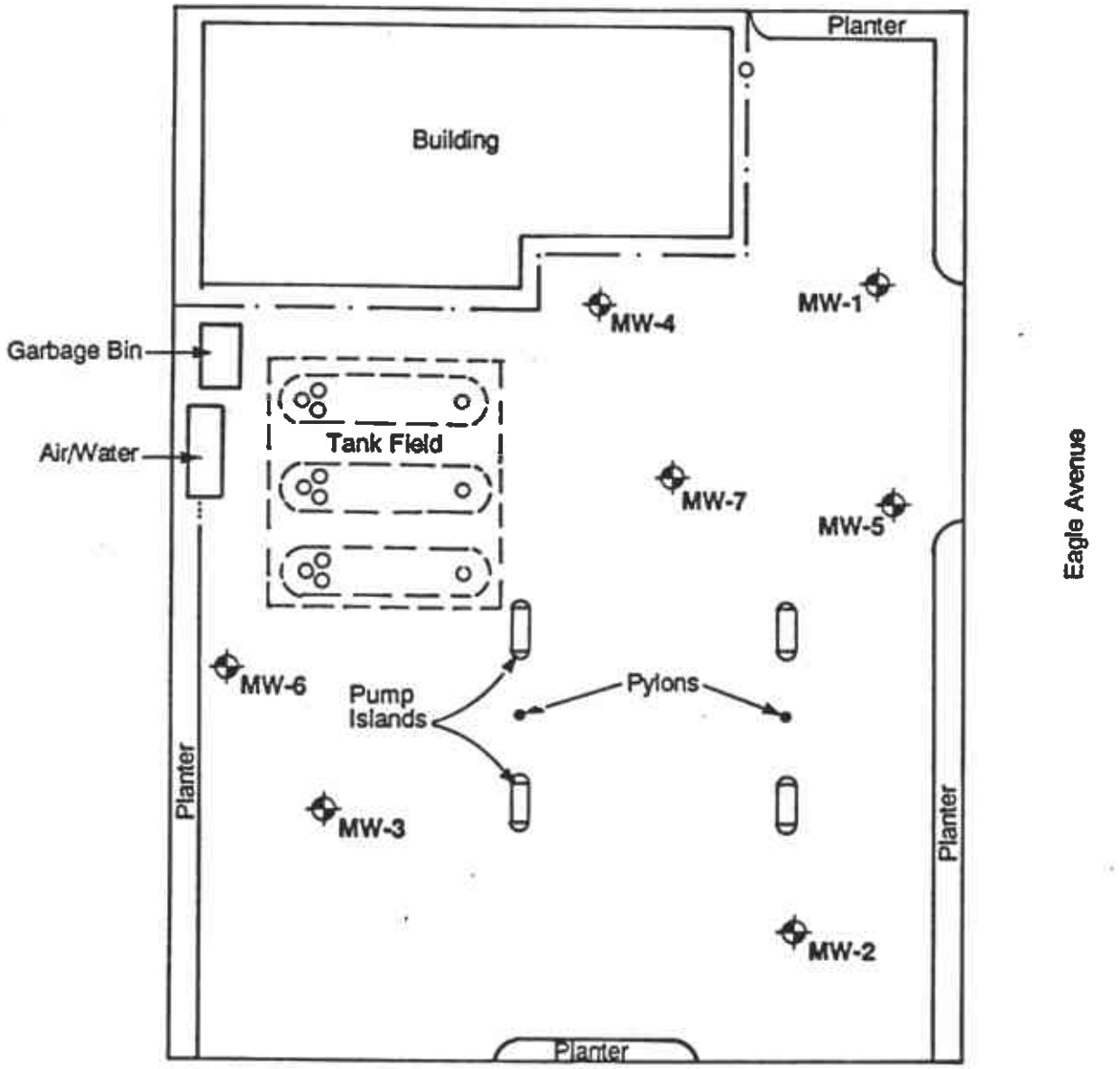


Harding Lawson Associates
Engineering and
Environmental Services

Area Map
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CVD	4167,309.02		3/90		



EXPLANATION

⊕ Monitoring Well Location

N

0 20 40

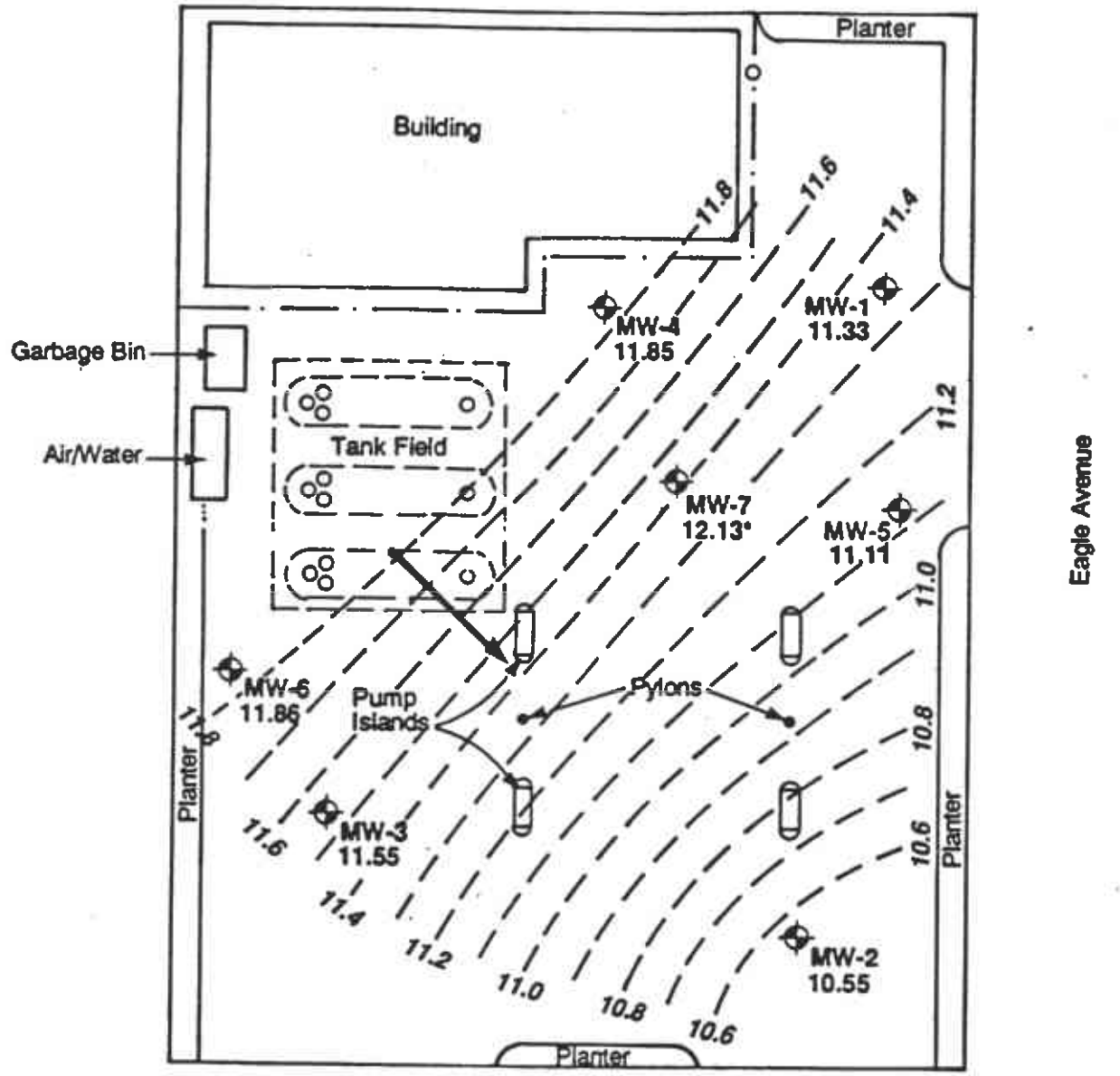
APPROXIMATE SCALE IN FEET

Harding Lawson Associates
Engineering and Environmental Services

Site Plan
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE **2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CVD	4167,309.02		3/90		



EXPLANATION

- Monitoring Well Location
- 11.55 Potentiometric Surface Elevation in Feet Above Mean Sea Level
- 11.6 Potentiometric Surface Elevation Contour
- Approximate Direction of Local Ground-Water Flow
- * Elevation not used for contouring (see text)

N

0 20 40

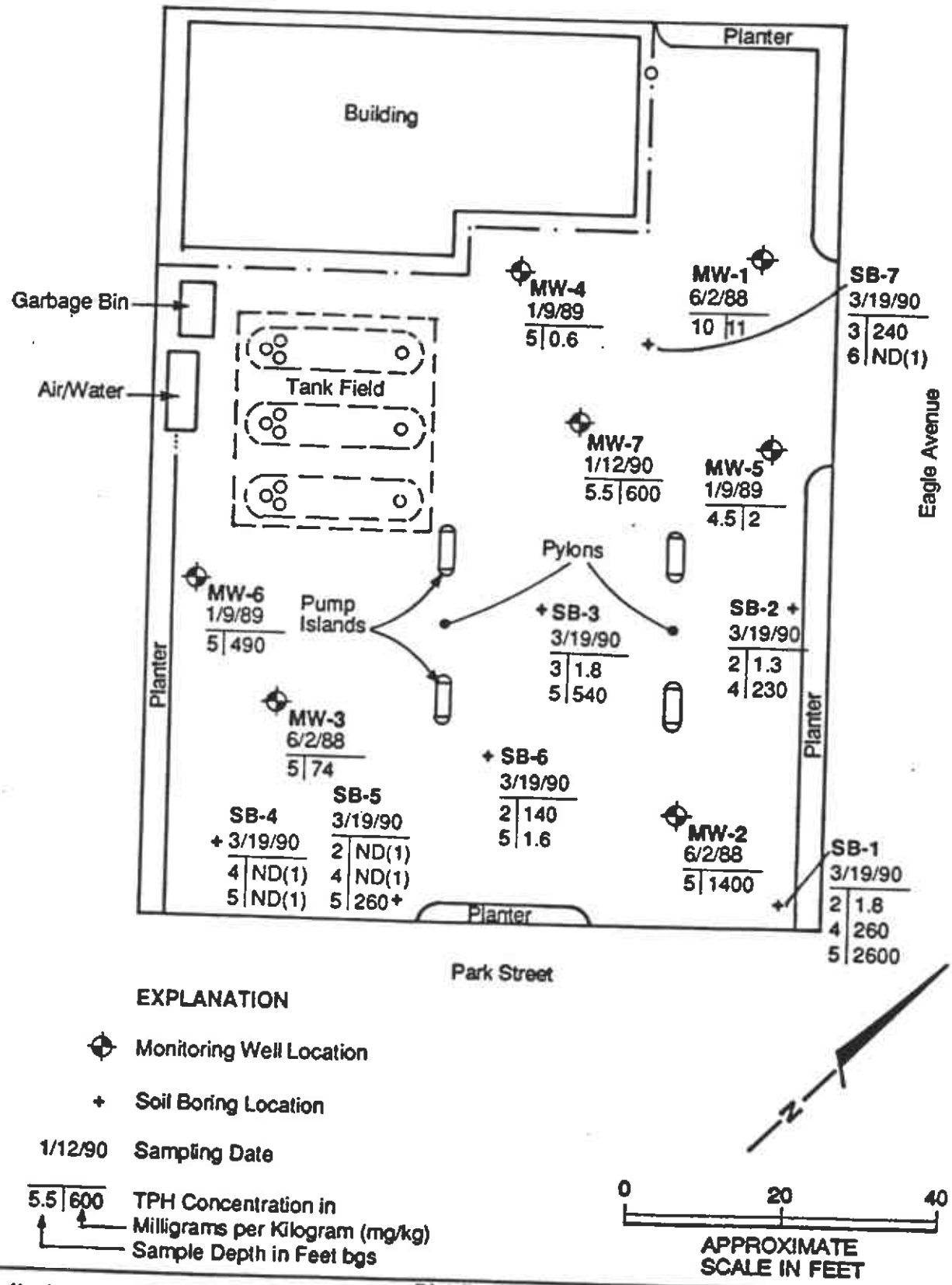
APPROXIMATE SCALE IN FEET

Harding Lawson Associates
Engineering and Environmental Services

Generalized Potentiometric Surface
Contour Map - February 13, 1990
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE 3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CVD	4167,309.02		3/90		

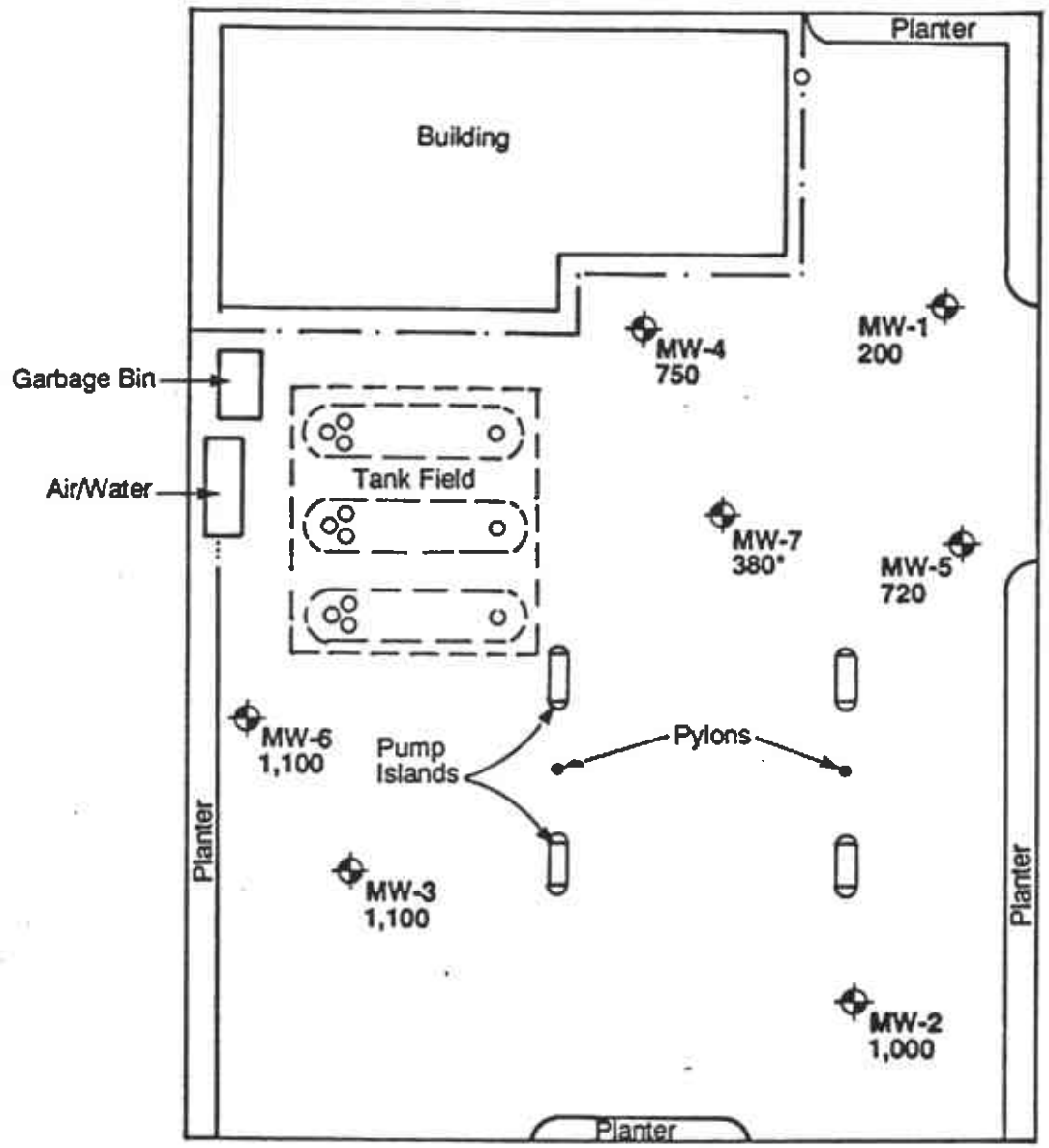


Harding Lawson Associates
Engineering and Environmental Services

Distribution of TPH Concentration in Soil Samples
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE 4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CVD	4167,309.02		3/90		



EXPLANATION

- Monitoring Well Location
- 1,100 Benzene Concentration in Micrograms per Liter (ug/l)
- * Result from Sample Collected on January 9,1990

N

0 20 40

APPROXIMATE SCALE IN FEET

Harding Lawson Associates
Engineering and Environmental Services

Distribution of Benzene Concentrations
In Groundwater Samples - December 11, 1989
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE 5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
CVD	4167,309.02		3/90		

Appendix A

BORING LOGS AND UNIFIED SOIL CLASSIFICATION SYSTEM

Appendix A

LIST OF ILLUSTRATIONS

Appendix A

LIST OF ILLUSTRATIONS

Top of SS Casing
Elevation_____

GROUND SURFACE

Equipment B-53

Elevation_____ Date 5/31/88

Blows/foot	OVA Reading (ppm)	Depth (ft)	Sample
		0	
30	2		
11	1	5	
23	25	10	
31	25	15	
36	35	20	
		25	
		30	
		35	
		40	

12 IN. DIAMETER BORING
0 to 21 ft
BENTONITE-CEMENT SEAL
0 to 4 ft
4 IN. DIAMETER SCHEDULE 40
PVC WELL CASING
0.5 to 6 ft
BENTONITE PELLET SEAL
4 to 5 ft

4 IN. DIAMETER SCHEDULE 40
SLOTTED WELL SCREEN
(0.020 in slot size)
6 to 21 ft

LONE STAR #3 SAND PACK
5 to 21.5 ft

4 IN. DIAMETER SCHEDULE 40
PVC BLANK SILT TRAP
21.5 to 22 ft
BOTTOM WELL CAP at 21.5 ft
HOLE CLEANED OUT TO
to 21.5 ft

A.C. Pavement
STRONG BROWN SANDY GRAVEL (GP) (7.5YR 5/6)
dense, moist
DARK BROWN SILTY SAND (SM) (10YR 3/3)
medium dense, moist

▽

DARK GRAY CLAYEY SAND (SC) (5Y 4/1)
medium dense, saturated
GRAY SAND (SP) (5Y 5/1)
medium dense, saturated

DARK YELLOWISH BROWN SAND (SP) (10YR 4/6)
medium dense, saturated, trace silt

DARK GRAY SILTY SAND (SM) (5Y 5/1)
medium dense, saturated

DARK GRAY SAND (SP) (5Y 5/1)
medium dense, saturated, with silt
bottom of boring at 22.0 ft

Harding Lawson Associates
Engineers and Geoscientists

Log of Boring and Well Completion Detail MW-1
Exxon - Alameda
Alameda, California

PLATE
A-1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	4167,309.02		6/88		

Top of SS Casing
Elevation_____

Equipment B-53
Elevation_____ Date 6/1/88

GROUND SURFACE

10-3/4 IN. DIAMETER BORING
0 to 16 ft
BENTONITE-CEMENT SEAL
0.5 to 2.5 ft

4 IN. DIAMETER SCHEDULE 40
PVC WELL CASING
0.5 to 4 ft
BENTONITE PELLET SEAL
2.5 to 3.5 ft
4 IN. DIAMETER SCHEDULE 40
SLOTTED WELL SCREEN
(0.020 in slot size)
4 to 15 ft

LONE STAR #3 SAND PACK
3.5 to 16 ft

4 IN. DIAMETER SCHEDULE 40
PVC BLANK SILT TRAP
15.5 to 16 ft

BOTTOM WELL CAP at 16 ft
HOLE CLEANED OUT TO
to 16 ft

Depth (ft)	Sample	Blows/foot	OVA Reading (ppm)	
0				A.C. Pavement STRONG BROWN SANDY GRAVEL (GP) dense, moist to wet
		27	0	VERY DARK GRAY SAND (SP) (5Y 3/1) medium dense, wet, fine-grained
5		21	700	MOTTLED DARK GRAY AND DARK YELLOWISH BROWN SILTY SAND (SM) (5Y 4/1; 10YR 4/6) medium dense, moist
				▼ decrease in silt
10		38	400	OLIVE GRAY SAND (SP) (5Y 5/2) medium dense, saturated, medium-grained
15		10	400	BROWN SAND (SP) medium dense, saturated, fine- to medium-grained, trace silt OLIVE SILTY SAND (SM) (10YR 4/3) loose, saturated, fine- to medium-grained bottom of boring at 16.0 ft
20				
25				
30				
35				
40				

Harding Lawson Associates
Engineers and Geoscientists

Log of Boring and Well Completion Detail MW-2
Exxon - Alameda
Alameda, California

PLATE
A-2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	4167,309.02		6/88		

Top of SS Casing Elevation_____

Equipment B-53

Elevation_____ Date 6/1/88

	Blows/foot	OVA Reading (ppm)	Depth (ft)	Sample
GROUND SURFACE			0	
10-3/4 IN. DIAMETER BORING 0 to 15.5 ft BENTONITE-CEMENT SEAL 0.5 to 2.5 ft 4 IN. DIAMETER SCHEDULE 40 PVC WELL CASING 0.5 to 4 ft BENTONITE PELLET SEAL 2.5 to 3.5 ft 4 IN. DIAMETER SCHEDULE 40 SLOTTED WELL SCREEN (0.020 in slot size) 4 to 14.5 ft LONE STAR #3 SAND PACK 3.5 to 14 ft 4 IN. DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 14.5 to 15.5 ft BOTTOM WELL CAP at 14.5 ft HOLE CLEANED OUT TO to 14.5 ft	41 16 6 28	0.6 400 40	5 10 15 20 25 30 35 40	

A.C.Pavement
STRONG BROWN SANDY GRAVEL (GP) (7.5YR 5/6) dense, moist
DARK GRAY SAND (SP) (5Y 3/1) medium dense, moist, fine- to medium-grained, trace silt becoming finer grained at 4 ft

color change to DARK GRAY (5Y 4/1) at 5.0 ft

▽ becomes wet at 7.0 ft

GRAY SAND (SP) (5Y 5/1) loose, wet

OLIVE BROWN SILTY SAND (SM) (2.5Y 4/4) medium dense, saturated, medium-grained

bottom of boring at 16.0 ft

Harding Lawson Associates
Engineers and Geoscientists

Log of Boring and Well Completion Detail MW-3

Exxon - Alameda

Alameda, California

PLATE A-3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	4167,309.02		6/88		

Top of PVC Casing Elevation ft

GROUND SURFACE

Equipment CME-75

Elevation _____ Date _____

Blows/foot	OVA (ppm)	Depth (ft)	Sample
		0	
10	50	5	
22	80	10	
8	0	15	
20	0	20	
		25	
		30	
		35	
		40	

10 IN. DIAMETER BORING
0 to 20.5 ft
4 IN. DIAMETER SCHEDULE 40 PVC WELL CASING
0.5 below ground to 4.0 ft
BENTONITE-CEMENT SEAL
0 to 3.0 ft
BENTONITE PELLET SEAL
3.0 to 3.5 ft

LONESTAR #3 SANDPACK
3.5 to 20.5 ft

4 IN. DIAMETER WELL SCREEN
(0.020 in. slot size)
4.0 to 19.0 ft

BOTTOM WELL CAP to 19.0 ft

BOREHOLE CLEANED OUT to 19.0 ft
BOTTOM OF BOREHOLE 20.5 ft

ASPHALT
GRAVEL (GW) (fill)
strong petroleum odor

DARK GRAYISH BROWN SILTY SAND (SM) 2.5Y 4/2
loose, moist, very strong petroleum odor

GREEN CLAYEY SAND (SC) loose, moist, medium-grained

GREEN SAND WITH MINOR SILT (SP) medium dense, saturated, poorly graded, medium-grained, petroleum odor

3" gravel layer at 14.0 ft
YELLOWISH BROWN SILTY SAND (SM) 10YR 5/6
loose, saturated, medium-grained
YELLOWISH BROWN SANDY SILT (ML) 10YR 5/6
medium stiff, saturated

GREEN SILTY SAND (SM) medium dense, saturated, medium-grained, with minor plant fragments

bottom of boring at 20.5 ft
converted to monitoring well MW-4.

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion Detail B4/MW4

Exxon - Alameda
Alameda, California

A-4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	4167.309.02		2/89		

Top of PVC Casing Elevation ft

GROUND SURFACE

Equipment CME-75

Elevation _____ Date _____

Blows/foot	OVA (ppm)	Depth (ft)	Sample	
		0		ASPHALT FILL BLACK SILTY SAND (SM) 10YR 2/1 damp, strong petroleum odor DARK GRAY SAND (SP) 5Y 4/1 moist
11	100	5		GREEN CLAYEY SILTY SAND (SM) medium dense, damp, angular, medium-grained sand strong petroleum odor
22	50	10		GREEN SAND (SP) medium dense, saturated, subangular medium-grained, with minor silt, petroleum odor
26		15		1" gravelly layer at 14.0 ft YELLOWISH BROWN SILTY SAND (SM) 10YR 5/4 medium dense, saturated, high percentage of silt
25	0	20		color change to green bottom of boring at 20.5 ft converted to monitoring well MW-5
		25		
		30		
		35		
		40		

10 IN. DIAMETER BORING
0 to 20.5 ft
4 IN. DIAMETER SCHEDULE 40 PVC WELL CASING
0.5 below ground to 4.0 ft
BENTONITE-CEMENT SEAL
0.5 to 3.0 ft
BENTONITE PELLET SEAL
3.0 to 3.5 ft

LONESTAR #3 SANDPACK
3.5 to 20.5 ft

4 IN. DIAMETER WELL SCREEN
(0.020 in. slot size)
4.0 to 19.0 ft

BOTTOM WELL CAP to 19.0 ft

BOREHOLE CLEANED OUT to 19.0 ft
BOTTOM OF BOREHOLE 20.5 ft

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion Detail B5/MW5

Exxon - Alameda
Alameda, California

A-5

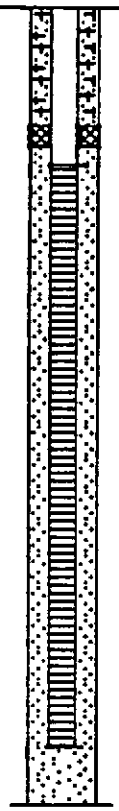
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	4167,309.02		2/89		

Top of PVC Casing Elevation ft

Equipment CME-75

Elevation _____ Date _____

Blows/foot	OVA (ppm)	Depth (ft)	Sample
		0	
5	100	5	
17	600	10	
11	0	15	
15	0	20	
		25	
		30	
		35	
		40	



GROUND SURFACE

10 IN. DIAMETER BORING
0 to 20.5 ft
4 IN. DIAMETER SCHEDULE 40 PVC WELL CASING
0.5 below ground to 4.0 ft
BENTONITE-CEMENT SEAL
0.5 to 3.0 ft
BENTONITE PELLET SEAL
3.0 to 3.5 ft

LONESTAR #3 SANDPACK
3.5 to 20.5 ft

4 IN. DIAMETER WELL SCREEN
(0.020 in. slot size)
4.0 to 19.0 ft

BOTTOM WELL CAP to 19.0 ft

BOREHOLE CLEANED OUT to 19.0 ft
BOTTOM OF BOREHOLE 20.5 ft

ASPHALT
BLACK SILTY CLAY WITH GRAVEL (CL) (fill)

strong petroleum odor

GREEN TO GREENISH DARK GRAY SILTY SAND (SM) loose, moist, medium-grained, subangular, very strong petroleum odor

GREEN SAND (SP) medium dense, saturated, medium-grained

1" gravel layer at 14.0 ft
YELLOWISH BROWN SANDY SILT (ML) 10YR 5/6 stiff, saturated, 25% sand

increase in sand content
YELLOWISH BROWN SILTY SAND (SM) 10YR 5/6 medium dense, saturated, medium-grained

bottom of boring at 20.5 ft
converted to monitoring well MW-6

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion Detail B6/MW6

Exxon - Alameda
Alameda, California

PLATE A-6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	4167,309.02		2/89		

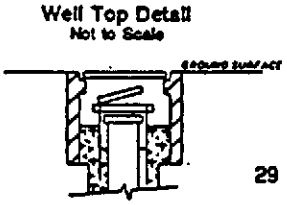
Top of PVC Casing Elevation 17.12 ft MSL

GROUND SURFACE

11" DIA. BOREHOLE
0 to 19.5 ft
BENTONITE-CEMENT GROUT
0 to 3 ft
4" DIA. SCHEDULE 40 PVC
BLANK CASING
0 to 4 ft
BENTONITE PELLET SEAL
3 to 3.5 ft
LONESTAR #3 SAND PACK
3.5 to 19.5 ft

4" DIA. SCHEDULE 40 PVC
WELL SCREEN
(0.020" slot size)
4 to 19 ft

BOTTOM WELL CAP at 19 ft



Blows/ft*	OVA (ppm)	Depth (ft)	Sample
	2	0	
	>1000		
11	>1000	5	
10	>1000	10	
6	40	15	
28	20	20	
29	5	25	
35	0	30	
44	0	35	
		40	

Equipment B-53 Hol. Stem Auger

Elevation 17.50 ft MSL Date 1/4/90

ASPHALT
GRAYISH BROWN PEA GRAVEL

VERY DARK GRAYISH BROWN SILTY SAND (SM) 2.5Y 3/2 medium dense, moist, strong petroleum odor, fine- to coarse-grained sand

▼ water level on 1/4/90
color change to very dark gray (2.5Y 3/0), with decreasing silt at 10 ft

color change to light olive-brown (2.5Y 5/4), increasing silt content at 15 ft

decreasing silt at 17.5 ft

DARK GREENISH GRAY SANDY CLAY (CL) 5G 4/1 stiff, wet
OLIVE-YELLOW SILTY SAND AND SANDY SILT (SM/ML) dense, wet

LIGHT OLIVE-BROWN SAND WITH SILT (SW) 2.5Y 5/6 dense, wet, no petroleum odor

color change to olive-gray (5Y 4/2) at 31 ft

slower drilling at 33 ft
OLIVE-GRAY SILTY SAND (SM) 5Y 4/2 dense, wet

slower drilling at 38 ft
DARK GREENISH GRAY CLAYEY SAND (SC) 5GY 4/1 dense, wet

bottom of boring at 40 ft

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion Detail MW-7

Exxon Station #7-0104
Alameda, California

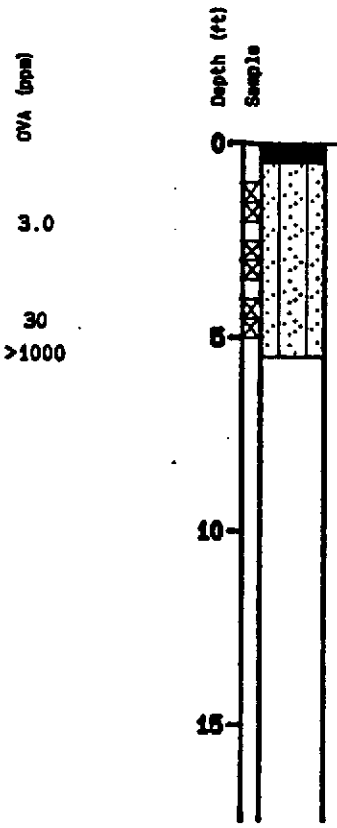
PLATE **A-7**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
	4167.309.02		2/90	

LOG OF BORING SB-1

Equipment Mobile B-24

Elevation ft MSL Date 3/19/90



3" ASPHALT, 3" GRAVEL SUBBASE
DARK BROWN SILTY SAND (SM) 7.5YR 4/2 loose, moist

increasing clay at 3.0 ft

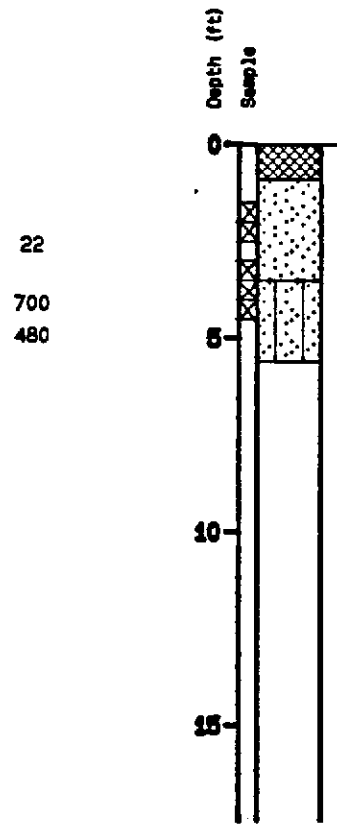
hydrocarbon odors at 4-5 ft

bottom of boring at 5.5 ft

LOG OF BORING SB-2

Equipment Mobile B-24

Elevation ft MSL Date 3/19/90



8" CONCRETE, 2" GRAVEL SUBBASE
DARK BROWN SAND (SP) 7.5YR 3/2 loose, dry, poorly graded

BROWN SILTY SAND (SM) 7.5YR 5/4 medium dense, moist, 10-15% clay, hydrocarbon odors

bottom of boring at 5.5 ft

Harding Lawson Associates
Engineering and Environmental Services

Logs of Borings SB-1 and SB-2
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE **A-8**

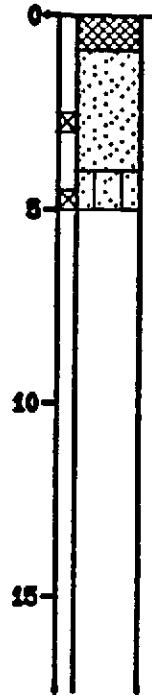
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
	4167, 309.02		4/90	

LOG OF BORING SB-3

Equipment Mobile B-24

Elevation ft MSL Date 3/19/90

OVA (ppm)	Depth (ft)	Sample
80	0	
30	5	
	10	
	15	



6" CONCRETE
2" GRAVEL SUBBASE
DARK BROWN SAND (SP) 7.5YR 4/4 dense, slightly moist, poorly graded, hydrocarbon odor

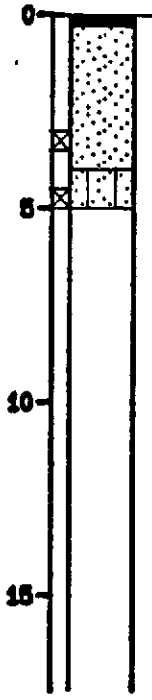
DARK GRAY SILTY SAND (SM) dense, moist, hydrocarbon odors
bottom of boring at 5.0 ft

LOG OF BORING SB-4

Equipment Mobile B-53

Elevation ft MSL Date 3/19/90

OVA (ppm)	Depth (ft)	Sample
6	0	
2	5	
	10	
	15	



3" ASPHALT
DARK BROWN SAND (SP) 7.5YR 3/4 loose, dry, poorly graded, fine- to medium-grained, no odor

DARK BROWN SILTY SAND (SM) 7.5YR 3/3 firm, slightly moist, 10-20% clay, no hydrocarbon odors
bottom of boring at 5.0 ft

Harding Lawson Associates
Engineering and Environmental Services

Logs of Borings SB-3 and SB-4
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE A-9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
	4167, 309.02		4/90	

LOG OF BORING SB-5

Equipment Mobile B-53

Elevation ft MSL Date 3/19/90

OVA (ppm)	Depth (ft)	Sample	
	0		3" ASPHALT 6" GRAVEL SUBBASE DARK GRAY SAND (SP) 7.5YR N/3 loose, dry, poorly graded, minor clay
8 >1000	5		BROWN SILTY/CLAYEY SAND (SM-SC) 7.5YR 4/4 dense, moist, with hydrocarbon odors decreasing clay at 5.0 ft bottom of boring at 6.0 ft
	10		
	15		

LOG OF BORING SB-6

Equipment Mobile B-53

Elevation ft MSL Date 3/19/90

Depth (ft)	Sample	
0		3" ASPHALT, 3" GRAVEL SUBBASE DARK BROWN SAND (SP) loose, moist very strong hydrocarbon odor
5		DARK GRAY SILTY SAND (SM) dense, moist, strong hydrocarbon odors bottom of boring at 5.0 ft
10		
15		

Harding Lawson Associates
Engineering and Environmental Services

Logs of Borings SB-5 and SB-6
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE **A-10**

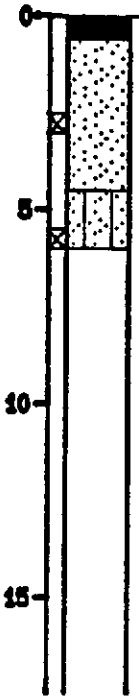
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
	4167.309.02		4/90	

LOG OF BORING SB-7

Equipment Mobile B-53

Elevation ft MSL Date 3/19/90

OVA (ppm)	Depth (ft)	Sample
	0	
120		
	5	
7		
	10	
	15	



3" ASPHALT

3" GRAVEL SUBBASE

DARK GRAY SAND (SP) loose, moist, poorly graded, hydrocarbon odors at 2.5-3.0 ft

DARK GRAY SILTY SAND (SM) dense, moist, faint hydrocarbon odors

bottom of boring at 6.0 ft

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring SB-7
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE A-11

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
	4167.309.02		4/90	

4672

MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP		POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC		CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP		POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL		ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC SILTS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION - ASTM D2487-85

Perm	—	Permeability
Consol	—	Consolidation
LL	—	Liquid Limit (%)
PI	—	Plastic Index (%)
G_s	—	Specific Gravity
MA	—	Particle Size Analysis
■	—	"Undisturbed" Sample
⊠	—	Bulk or Classification Sample

Shear Strength (psi) ↓ ; Confining Pressure ↓

TxUU (FM) or (S)	3200	(2600)	—	Unconsolidated Undrained Triaxial Shear (field moisture or saturated)
TxCU (P)	3200	(2600)	—	Consolidated Undrained Triaxial Shear (with or without pore pressure measurement)
TxCD	3200	(2600)	—	Consolidated Drained Triaxial Shear
SSCU (P)	3200	(2600)	—	Simple Shear Consolidated Undrained (with or without pore pressure measurement)
SSCD	3200	(2600)	—	Simple Shear Consolidated Drained
DSCD	2700	(2000)	—	Consolidated Drained Direct Shear
UC	470		—	Unconfined Compression
LVS	700		—	Laboratory Vane Shear

KEY TO TEST DATA

Harding Lawson Associates
Engineers and Geoscientists

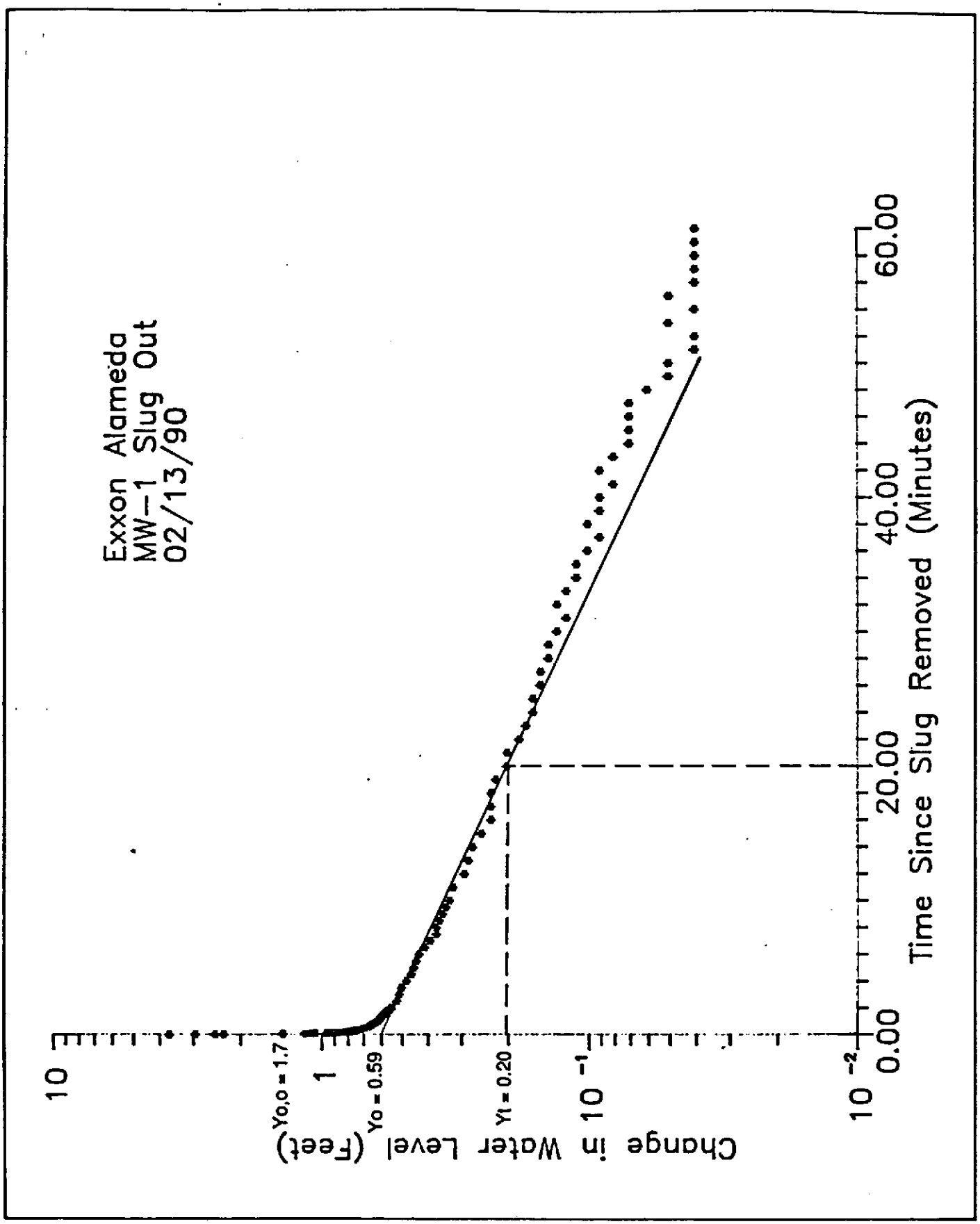
Unified Soil Classification Chart
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station # 7-0104
Alameda, California

PLATE **A-12**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
IC	4167,309.02		4/90		

Appendix B

SLUG TEST DATA
LIST OF ILLUSTRATIONS



Harding Lawson Associates
Engineering and Environmental Services

Slug Test of MW-1
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE **B-1**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CVD	4167,309.02		3/90	

Slug Test of Well MW-1

Rising Head Test (Slug removed from well)
Partially Penetrating Well

Method of Analysis: Bouwer and Rice (1976)

H	Hydraulic head above bottom of well screen	14.7	feet
L	Length of well screen through which water enters/exits well	14.7	feet
D	Saturated thickness of aquifer	28.7	feet
r	Radius of well casing	0.17	feet
r_w	Radius of wellbore	0.5	feet
ϕ	Porosity of gravel pack	0.24	unitless
r_c	Effective radius of well casing (including porosity of gravel pack)	0.29	feet

$r_c = [r^2 + \phi(r_w^2 - r^2)]^{1/2}$

L/r_w 29.4 unitless

Calculation of $\ln R_e/r_w$:

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(H/r_w)} + \frac{A+B\ \ln[(D-H)/r_w]}{L/r_w}}$$

where: R_e = Effective radial distance in which the head change is dissipated

A,B = dimensionless parameters which are a function of L/r_w, determined from analog model studies conducted by Bouwer and Rice (1976)

A = 2.5 (unitless), B = 0.4 (unitless)

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(14.7/0.5)} + \frac{(2.5) + (0.4)\ \ln\ [(28-14)/0.5]}{14.7\ /\ 0.5}}$$

$\ln R_e/r_w$ = 2.2

Rising Head Test (Slug removed from well)
Partially Penetrating Well

HYDRAULIC CONDUCTIVITY (K)

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where: y_o = zero time y-axis intercept of linear portion of recovery data

y_o = 0.59 feet

y_t = y-axis intercept at time (t) of linear portion of recovery data

y_t = 0.20 feet

t = 1200 seconds

$$K = \frac{(0.29)^2 (2.2)}{2(14.7)} \frac{1}{1200} \ln \frac{0.59}{0.20}$$

$K = 5.7 \times 10^{-6}$ feet/second

$K = 3.4 \times 10^{-4}$ feet/minute

K = 0.49 feet/day

$K = 1.7 \times 10^{-4}$ centimeters/second

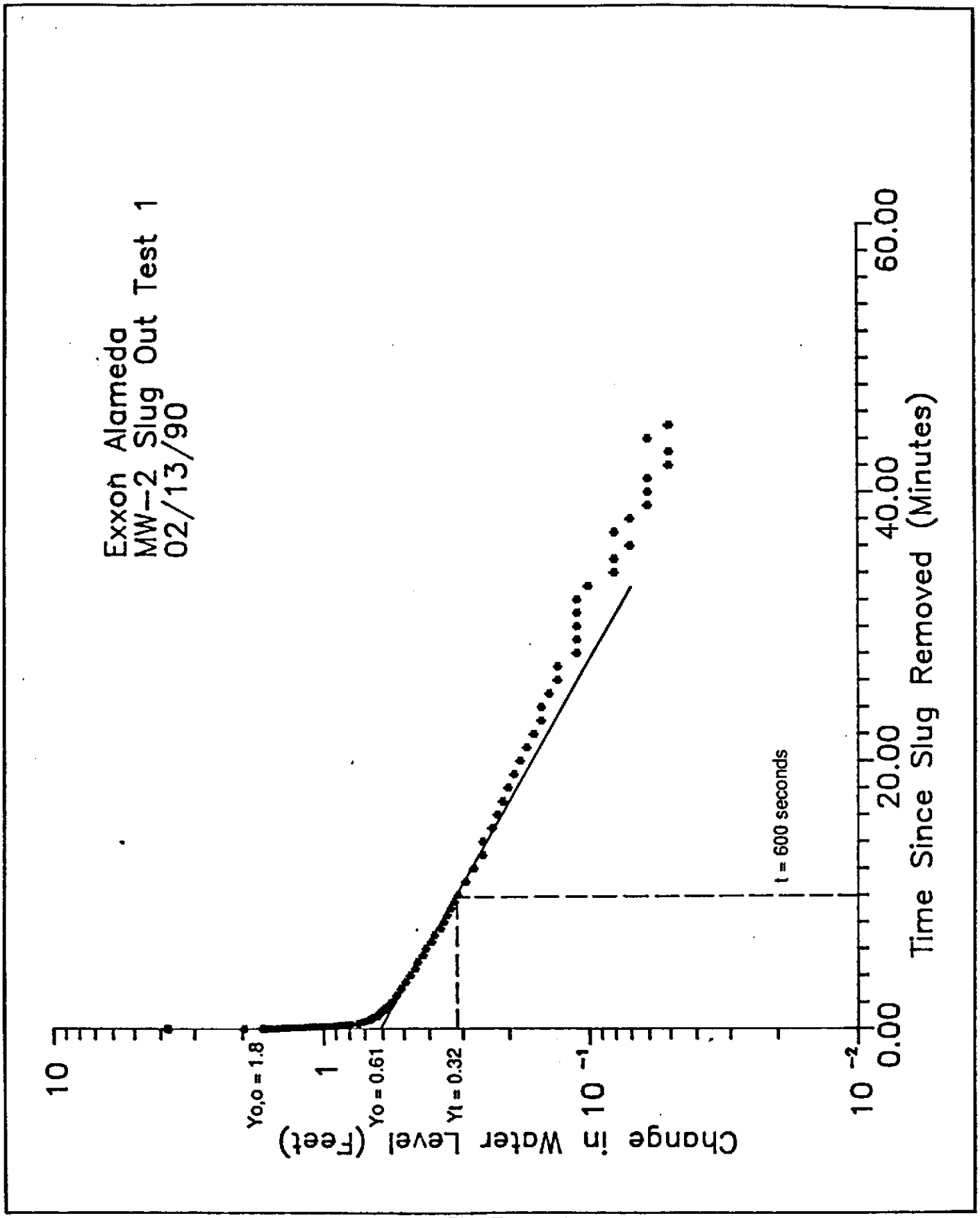
Slug Test of Well MW-1
Rising Head Test (Slug Removed from Well)

Method of Analysis: Bouwer (1989) — **Calculation of ϕ**

r	Radius of well casing	0.17 feet
r_w	Radius of well bore	0.45 feet
$Y_{o,o}$	Zero time y-axis intercept of first linear portion of recovery data	1.7 feet
Y_o	Zero time y-axis intercept of second linear portion of recovery data	0.59 feet
ϕ	Porosity of gravel pack	

$$\phi = \frac{r^2}{\left[\frac{Y_{o,o}}{(Y_{o,o} - Y_o)} - 1\right](r^2_w - r^2)}$$

ϕ = 0.24



Harding Lawson Associates
Engineering and Environmental Services

Slug Test 1 of MW-2
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE **B-2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CVD	4167.309.02		3/90	

Slug Test of Well MW-2
Test 1

Rising Head Test (Slug removed from well)
Partially Penetrating Well

Method of Analysis: Bouwer and Rice (1976)

H	Hydraulic head above bottom of well screen	8.7	feet
L	Length of well screen through which water enters/exits well	8.7	feet
D	Saturated thickness of aquifer	28.7	feet
r	Radius of well casing	0.17	feet
r_w	Radius of wellbore	0.45	feet
ϕ	Porosity of gravel pack	0.32	unitless
r_c	Effective radius of well casing (including porosity of gravel pack)	0.29	feet

$r_c = [r^2 + \phi(r_w^2 - r^2)]^{1/2}$

L/r_w 19.3 unitless

Calculation of $\ln R_e/r_w$:

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(H/r_w)} + \frac{A+B \ln[(D-H)/r_w]}{L/r_w}}$$

where: R_e = Effective radial distance in which the head change is dissipated

A,B = dimensionless parameters which are a function of L/r_w, determined from analog model studies conducted by Bouwer and Rice (1976)

A = 2.0 (unitless), B = 0.3 (unitless)

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(8.7/0.45)} + \frac{(2.0) + (0.3) \ln[(28-8)/0.45]}{8.7/0.45}}$$

$\ln R_e/r_w$ = 1.9

Rising Head Test (Slug removed from well)
Partially Penetrating Well

HYDRAULIC CONDUCTIVITY (K)

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where: y_o = zero time y-axis intercept of linear portion of recovery data

y_o = 0.61 feet

y_t = y-axis intercept at time (t) of linear portion of recovery data

y_t = 0.32 feet

t = 600 seconds

$$K = \frac{(0.29)^2 (1.9)}{2(8.7)} \frac{1}{600} \ln \frac{0.61}{0.32}$$

K = 9.9×10^{-6} feet/second

K = 5.9×10^{-4} feet/minute

K = 0.86 feet/day

K = 3.0×10^{-4} centimeters/second

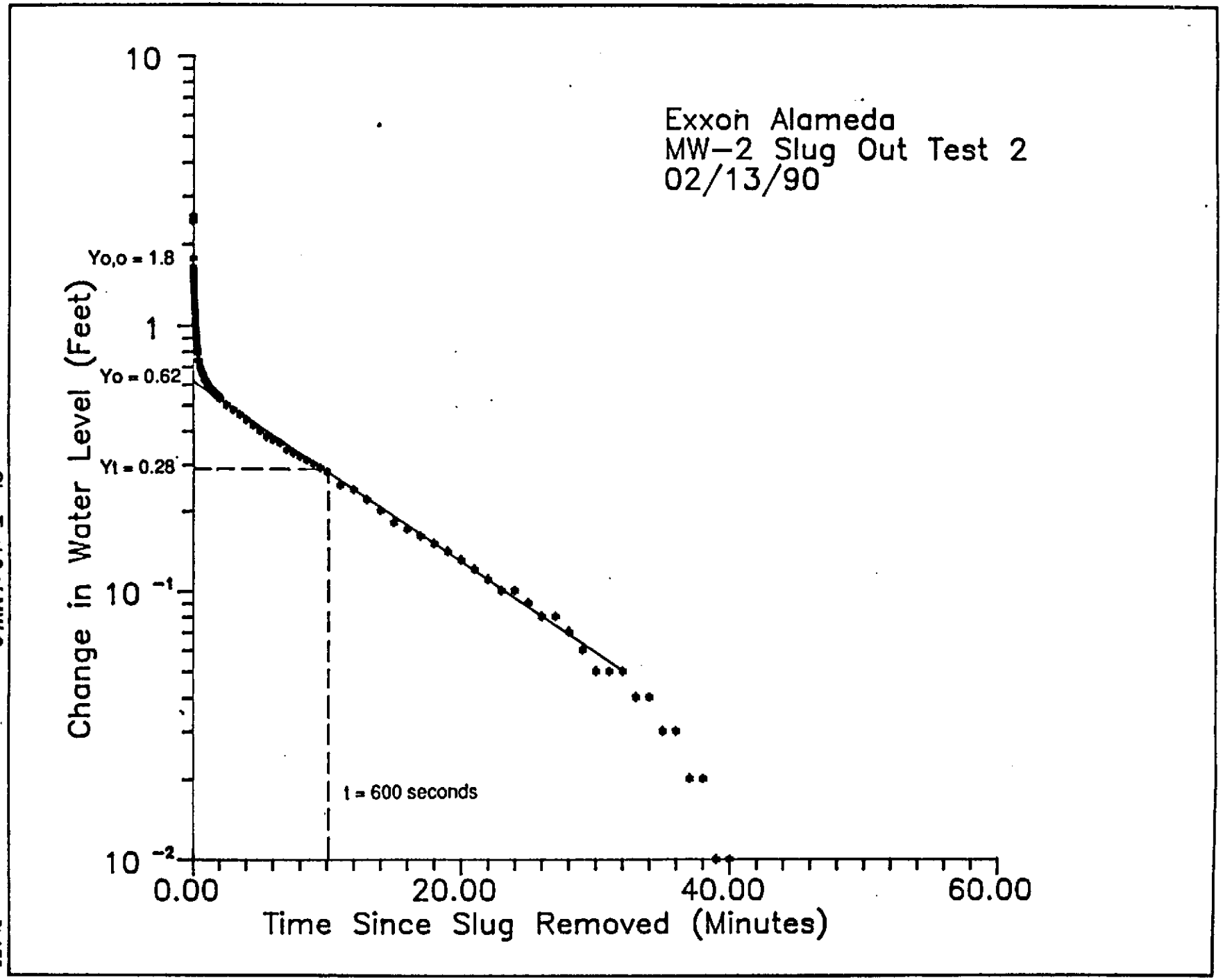
Slug Test of Well MW-2 Test 1
Rising Head Test (Slug Removed from Well)

Method of Analysis: Bouwer (1989) — **Calculation of ϕ**

r	Radius of well casing	0.17 feet
r_w	Radius of well bore	0.45 feet
$Y_{o,o}$	Zero time y-axis intercept of first linear portion of recovery data	1.8 feet
Y_o	Zero time y-axis intercept of second linear portion of recovery data	0.61 feet
ϕ	Porosity of gravel pack	

$$\phi = \frac{r^2}{\left[\frac{Y_{o,o}}{(Y_{o,o} - Y_o)} - 1\right](r^2_w - r^2)}$$

ϕ = 0.32



Harding Lawson Associates
Engineering and Environmental Services

DRAWN CVD
JOB NUMBER 4167,309.02
APPROVED
DATE 3/90
REVISED DATE

Slug Test 2 of MW-2
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE B-3

Slug Test of Well MW-2 Test 2

Rising Head Test (Slug removed from well)
Partially Penetrating Well

Method of Analysis: Bouwer and Rice (1976)

H	Hydraulic head above bottom of well screen	8.7	feet
L	Length of well screen through which water enters/exits well	8.7	feet
D	Saturated thickness of aquifer	28.7	feet
r	Radius of well casing	0.17	feet
r_w	Radius of wellbore	0.45	feet
ϕ	Porosity of gravel pack	0.32	unitless
r_c	Effective radius of well casing (including porosity of gravel pack)	0.29	feet

$r_c = [r^2 + \phi(r_w^2 - r^2)]^{1/2}$

L/r_w 19.3 unitless

Calculation of $\ln R_e/r_w$:

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(H/r_w)} + \frac{A+B\ln[(D-H)/r_w]}{L/r_w}}$$

where: R_e = Effective radial distance in which the head change is dissipated

A,B = dimensionless parameters which are a function of L/r_w, determined from analog model studies conducted by Bouwer and Rice (1976)

A = 2.0 (unitless), B = 0.3 (unitless)

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(8.7/0.45)} + \frac{(2.0) + (0.3)\ln[(28.8)/0.45]}{8.7 / 0.45}}$$

$\ln R_e/r_w$ = 1.9

Rising Head Test (Slug removed from well)
Partially Penetrating Well

HYDRAULIC CONDUCTIVITY (K)

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where: y_o = zero time y-axis intercept of linear portion of recovery data

y_o = 0.62 feet

y_t = y-axis intercept at time (t) of linear portion of recovery data

y_t = 0.28 feet

t = 600 seconds

$$K = \frac{(0.29)^2 (1.9)}{2(8.7)} \frac{1}{600} \ln \frac{0.62}{0.28}$$

$K = 1.2 \times 10^{-5}$ feet/second

$K = 7.2 \times 10^{-4}$ feet/minute

K = 1.04 feet/day

$K = 3.7 \times 10^{-4}$ centimeters/second

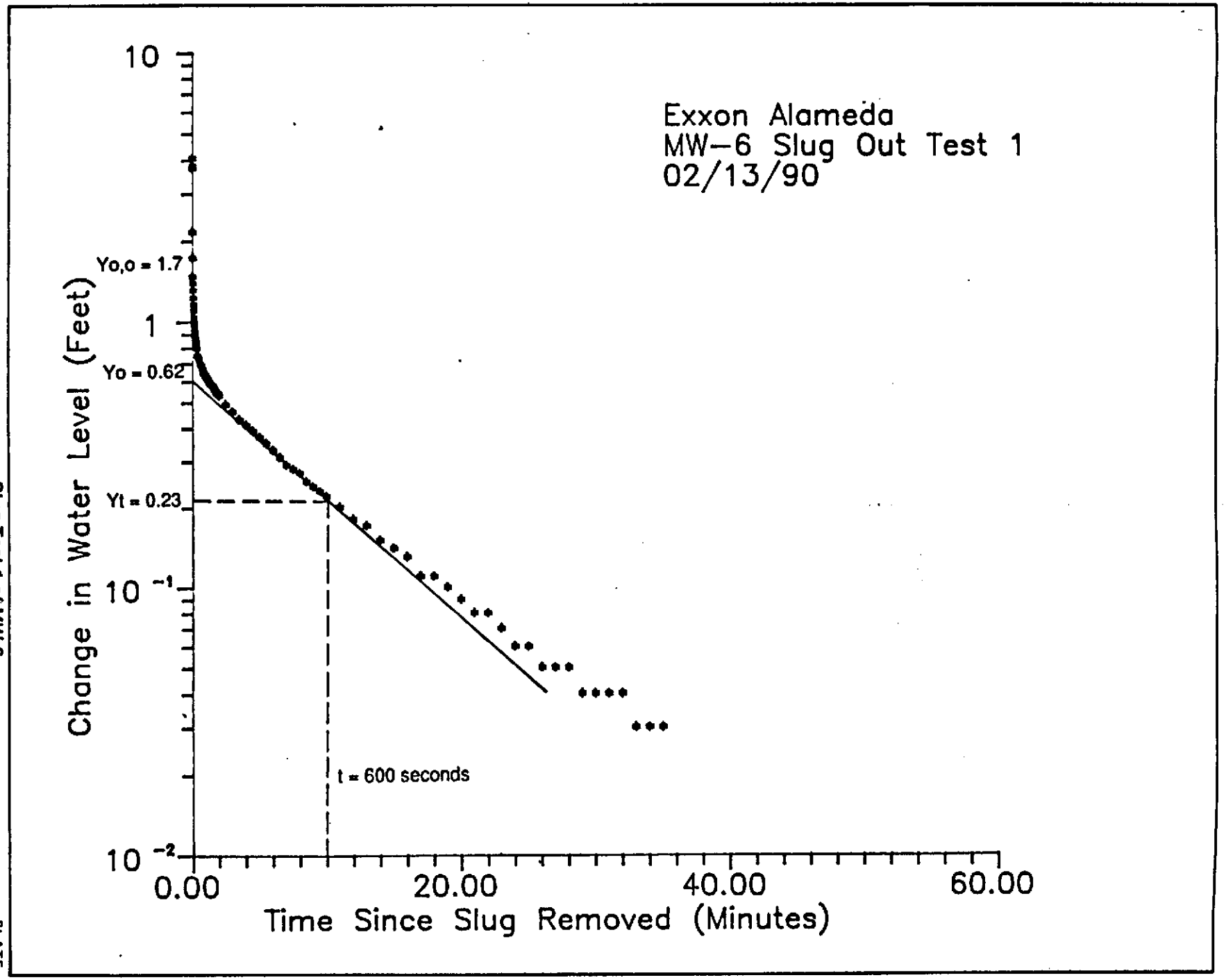
Slug Test of Well MW-2 Test 2
Rising Head Test (Slug Removed from Well)

Method of Analysis: Bouwer (1989) — **Calculation of ϕ**

r	Radius of well casing	0.17 feet
r_w	Radius of well bore	0.45 feet
$Y_{o,o}$	Zero time y-axis intercept of first linear portion of recovery data	1.8 feet
Y_o	Zero time y-axis intercept of second linear portion of recovery data	0.62 feet
ϕ	Porosity of gravel pack	

$$\phi = \frac{r^2}{\left[\frac{Y_{o,o}}{(Y_{o,o} - Y_o)} - 1\right](r^2_w - r^2)}$$

$\phi = 0.32$



Harding Lawson Associates
Engineering and Environmental Services

DRAWN CVD
JOB NUMBER 4167,309.02
APPROVED
DATE 3/90
REVISED DATE

Slug Test 1 of MW-6
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE B-4

Slug Test of Well MW-6 Test 1

Rising Head Test (Slug removed from well)
Partially Penetrating Well

Method of Analysis: Bouwer and Rice (1976)

H	Hydraulic head above bottom of well screen	12.9	feet
L	Length of well screen through which water enters/exits well	12.9	feet
D	Saturated thickness of aquifer	28.9	feet
r	Radius of well casing	0.17	feet
r_w	Radius of wellbore	0.42	feet
ϕ	Porosity of gravel pack	0.34	unitless
r_c	Effective radius of well casing (including porosity of gravel pack)	0.28	feet

$r_c = [r^2 + \phi(r_w^2 - r^2)]^{1/2}$

L/r_w 30.7 unitless

Calculation of $\ln R_e/r_w$:

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(H/r_w)} + \frac{A+B\ln[(D-H)/r_w]}{L/r_w}}$$

where: R_e = Effective radial distance in which the head change is dissipated

A,B = dimensionless parameters which are a function of L/r_w, determined from analog model studies conducted by Bouwer and Rice (1976)

A = 2.5 (unitless), B = 0.4 (unitless)

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(12.9/0.42)} + \frac{(2.5) + (0.4)\ln[(28-12)/0.42]}{12.9 / 0.42}}$$

$\ln R_e/r_w$ = 2.2

Rising Head Test (Slug removed from well)
Partially Penetrating Well

HYDRAULIC CONDUCTIVITY (K)

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where: y_o = zero time y-axis intercept of linear portion of recovery data

y_o = 0.62 feet

y_t = y-axis intercept at time (t) of linear portion of recovery data

y_t = 0.23 feet

t = 600 seconds

$$K = \frac{(0.28)^2 (2.2)}{2(12.9)} \frac{1}{600} \ln \frac{0.62}{0.23}$$

$K = 1.1 \times 10^{-5}$ feet/second

$K = 6.6 \times 10^{-4}$ feet/minute

K = 0.95 feet/day

$K = 3.4 \times 10^{-4}$ centimeters/second

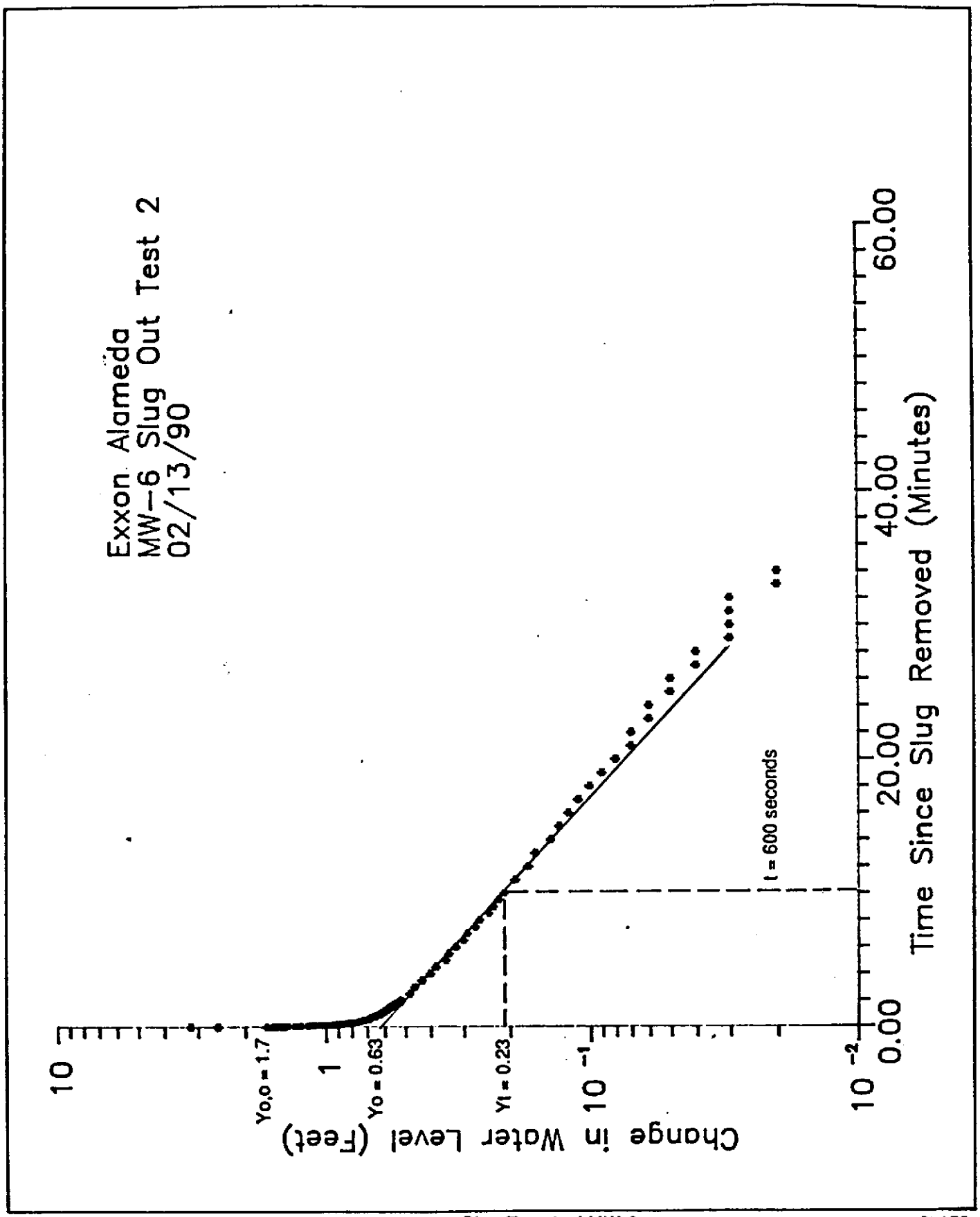
Slug Test of Well MW-6 Test 1
Rising Head Test (Slug Removed from Well)

Method of Analysis: Bouwer (1989) — **Calculation of ϕ**

r	Radius of well casing	0.17 feet
r_w	Radius of well bore	0.42 feet
$Y_{o,o}$	Zero time y-axis intercept of first linear portion of recovery data	1.7 feet
Y_o	Zero time y-axis intercept of second linear portion of recovery data	0.62 feet
ϕ	Porosity of gravel pack	

$$\phi = \frac{r^2}{\left[\frac{Y_{o,o}}{(Y_{o,o} - Y_o)} - 1\right](r^2_w - r^2)}$$

ϕ = 0.34



Harding Lawson Associates
Engineering and Environmental Services

Slug Test 2 of MW-6
Phase III Evaluation of Petroleum Hydrocarbons
Exxon Station #7-0104
Alameda, California

PLATE
B-5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
CVD	4167,309.02		3/90	

Slug Test of Well MW-6 Test 2 **Harding Lawson Associates**

Rising Head Test (Slug removed from well)
Partially Penetrating Well

Method of Analysis: Bouwer and Rice (1976)

H	Hydraulic head above bottom of well screen	12.9	feet
L	Length of well screen through which water enters/exits well	12.9	feet
D	Saturated thickness of aquifer	28.9	feet
r	Radius of well casing	0.17	feet
r_w	Radius of wellbore	0.42	feet
ϕ	Porosity of gravel pack	0.33	unitless
r_c	Effective radius of well casing (including porosity of gravel pack)	0.28	feet

$r_c = [r^2 + \phi(r_w^2 - r^2)]^{1/2}$

L/r_w 30.7 unitless

Calculation of ln R_e/r_w:

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(H/r_w)} + \frac{A+B\ln[(D-H)/r_w]}{L/r_w}}$$

where: R_e = Effective radial distance in which the head change is dissipated

A,B = dimensionless parameters which are a function of L/r_w, determined from analog model studies conducted by Bouwer and Rice (1976)

A = 2.5 (unitless), B = 0.4 (unitless)

$$\ln R_e/r_w = \frac{1}{\frac{1.1}{\ln(12.9/0.42)} + \frac{(2.5) + (0.4)\ln[(28.12)/0.42]}{12.9 / 0.42}}$$

$\ln R_e/r_w$ = 2.2

Slug Test of Well MW-6 Test 2
Rising Head Test (Slug Removed from Well)

Method of Analysis: Bouwer (1989) — **Calculation of ϕ**

r	Radius of well casing	0.17 feet
r_w	Radius of well bore	0.42 feet
$Y_{o,o}$	Zero time y-axis intercept of first linear portion of recovery data	1.7 feet
Y_o	Zero time y-axis intercept of second linear portion of recovery data	0.63 feet
ϕ	Porosity of gravel pack	

$$\phi = \frac{r^2}{\left[\frac{Y_{o,o}}{(Y_{o,o} - Y_o)} - 1\right](r^2_w - r^2)}$$

$\phi = 0.33$

Rising Head Test (Slug removed from well)
Partially Penetrating Well

HYDRAULIC CONDUCTIVITY (K)

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where: y_o = zero time y-axis intercept of linear portion of recovery data

y_o = 0.63 feet

y_t = y-axis intercept at time (t) of linear portion of recovery data

y_t = 0.23 feet

t = 600 seconds

$$K = \frac{(0.28)^2 (2.2)}{2(12.9)} \frac{1}{600} \ln \frac{0.63}{0.23}$$

$K = 1.1 \times 10^{-5}$ feet/second

$K = 6.6 \times 10^{-4}$ feet/minute

K = 0.95 feet/day

$K = 3.4 \times 10^{-4}$ centimeters/second

Appendix C

LABORATORY ANALYTICAL REPORTS

NATIONAL ENVIRONMENTAL TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

APR 90 5:47

Michelle Watson
Harding Lawson Associates
200 Rush Landing
Novato, CA 94947

Date: 04-03-90
NET Client Acct No: 281
NET Pacific Log No: 1228
Received: 03-20-90 1700

Client Reference Information

EXXON, Alameda; Job: 4167,309.02

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

Enclosure(s)

Client Acct: 281
Client Name: Harding Lawson Associates
NET Log No: 1228

Date: 04-03-90
Page: 2

Ref: EXXON, Alameda; Job: 4167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90SB0501 03-19-90 1305 49114	90SB0502 03-19-90 1315 49115	90SB0503 03-19-90 1320 49116	Units
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		1	1	50	
DATE ANALYZED		03-28-90	03-28-90	03-28-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	ND	ND	260	mg/Kg
METHOD 8020		--	--	--	
Benzene	2.5	28	150	1,300	ug/Kg
Ethylbenzene	2.5	6.5	16	4,000	ug/Kg
Toluene	2.5	6.0	80	6,500	ug/Kg
Xylenes, total	2.5	16	69	24,000	ug/Kg

Ref: EXXON, Alameda; Job: 4167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90SB0601 03-19-90 1335 49117	 90SB0603 03-19-90 1345 49118	 90SB0701 03-19-90 1405 49119	Units
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		50	1	50	
DATE ANALYZED		03-29-90	03-28-90	03-30-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	140	1.6	240	mg/Kg
METHOD 8020		--	--	--	
Benzene	2.5	1100	65	260	ug/Kg
Ethylbenzene	2.5	1700	19	1200	ug/Kg
Toluene	2.5	1200	20	1400	ug/Kg
Xylenes, total	2.5	6700	60	4700	ug/Kg

Ref: EXXON, Alameda; Job: 4167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90SB0702 03-19-90 1415 49120	 90SB0102 03-19-90 0855 49121	 90SB0105 03-19-90 0930 49122	Units
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		1	1	50	
DATE ANALYZED		03-30-90	03-28-90	03-30-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	ND	1.8	260	mg/Kg
METHOD 8020		--	--	--	
Benzene	2.5	55	6.2	1300	ug/Kg
Ethylbenzene	2.5	12	16	1400	ug/Kg
Toluene	2.5	4.1	ND	1300	ug/Kg
Xylenes, total	2.5	11	9.2	4900	ug/Kg

Client Acct: 281
Client Name: Harding Lawson Associates
NET Log No: 1228

Date: 04-03-90
Page: 5

Ref: EXXON, Alameda; Job: 4167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90SB0106 03-19-90 0945 49123	 90SB0202 03-19-90 1030 49124	 90SB0204 03-19-90 1050 49125	Units
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		250	1	20	
DATE ANALYZED		03-29-90	03-28-90	03-29-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	2600	1.3	230	mg/Kg
METHOD 8020		--	--	--	
Benzene	2.5	6900	13	1200	ug/Kg
Ethylbenzene	2.5	32000	10	2100	ug/Kg
Toluene	2.5	23000	18	3700	ug/Kg
Xylenes, total	2.5	140000	54	13000	ug/Kg

Ref: EXXON, Alameda; Job: 4167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90SB0301 03-19-90 1127 49126	 90SB0302 03-19-90 1135 49127	 90SB0401 03-19-90 1227 49128	Units
PETROLEUM HYDROCARBONS		--	--	--	
VOLATILE (SOIL)		--	--	--	
DILUTION FACTOR *		1	50	1	
DATE ANALYZED		03-28-90	03-30-90	03-28-90	
METHOD GC FID/5030		--	--	--	
as Gasoline	1	1.8	540	ND	mg/Kg
METHOD 8020		--	--	--	
Benzene	2.5	6.8	4600	ND	ug/Kg
Ethylbenzene	2.5	47	12000	5.3	ug/Kg
Toluene	2.5	11	3200	ND	ug/Kg
Xylenes, total	2.5	230	44000	18	ug/Kg

Ref: EXXON, Alameda; Job: 4167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90SB0402 03-19-90 1240 49129	Units
PETROLEUM HYDROCARBONS		--	
VOLATILE (SOIL)		--	
DILUTION FACTOR *		1	
DATE ANALYZED		03-28-90	
METHOD GC FID/5030		--	
as Gasoline	1	ND	mg/Kg
METHOD 8020		--	
Benzene	2.5	ND	ug/Kg
Ethylbenzene	2.5	ND	ug/Kg
Toluene	2.5	ND	ug/Kg
Xylenes, total	2.5	ND	ug/Kg

Ref: EXXON, Alameda; Job: 4167,309.02

QUALITY CONTROL RESULTS - TOTAL PETROLEUM HYDROCARBONS (soil)

Parameter	Reporting Limits	Units	Blank Results	Lab No. Spike and Spike Replicate Results (% Recovery) (-49114S)	(-49114SR)	RPD
as Gasoline	1.0	mg/Kg	ND	87.9	88.1	<1
Benzene	2.5	ug/Kg	ND	100	92.2	8.9
Toluene	2.5	ug/Kg	ND	105	102.9	2.3

QUALITY CONTROL RESULTS - TOTAL PETROLEUM HYDROCARBONS (soil)

Parameter	Reporting Limits	Units	Blank Results	Lab No. Spike and Spike Replicate Results (% Recovery) (-49457S)	(-49457SR)	RPD
as Gasoline	1.0	mg/Kg	ND	83	88	5.8
Benzene	2.5	ug/Kg	ND	104.3	103.1	1.2
Toluene	2.5	ug/Kg	ND	101.2	95.5	5.8

QUALITY CONTROL RESULTS - TOTAL PETROLEUM HYDROCARBONS (soil)

Parameter	Reporting Limits	Units	Blank Results	Lab No. Spike and Spike Replicate Results (% Recovery) (-49596S)	(-49596SR)	RPD
as Gasoline	1.0	mg/Kg	ND	96	88	8.7
Benzene	2.5	ug/Kg	ND	92	98	6.3
Toluene	2.5	ug/Kg	ND	106	101	4.8

KEY TO ABBREVIATIONS and METHOD REFERENCES

<	:	Less than; When appearing in results column indicates analyte not detected at the value following, which supercedes the listed reporting limit.
mean	:	Average; sum of measurements divided by number of measurements.
mg/Kg (ppm)	:	Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
mg/L	:	Concentration in units of milligrams of analyte per liter of sample.
mL/L/hr	:	Milliliters per liter per hour.
MPN/100 mL	:	Most probable number of bacteria per one hundred milliliters of sample.
N/A	:	Not applicable.
NA	:	Not analyzed.
ND	:	Not detected; the analyte concentration is less than applicable listed reporting limit.
NTU	:	Nephelometric turbidity units.
RPD	:	Relative percent difference, 100 [Value 1 - Value 2]/mean value.
SNA	:	Standard not available.
ug/Kg (ppb)	:	Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
ug/L	:	Concentration in units of micrograms of analyte per liter of sample.
umhos/cm	:	Micromhos per centimeter.

Method References

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

* Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated reporting limits by the dilution factor.

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1226

CHAIN OF CUSTODY FORM

Lab: NET

Samplers: JOHN SKALBECK

Job Number: 4167,309.02

Name/Location: Exxon Alameda

Project Manager: M. Watson

Recorder: John Skalbeck (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES
48			X		1			90	SB	0501	90	03	19	1305	
			X		1			90	SB	0502				1315	
			X		1			90	SB	0503				1320	
			X		1			90	SB	0601				1335	
			X		1			90	SB	0602				1340	GDS
			X		1			90	SB	0603				1345	
			X		1			90	SB	0701				1405	
			X		1			90	SB	0702				1415	

ANALYSIS REQUESTED

EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Plitnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb. (as Gasoline)
					X	X
					X	X
					X	X
					X	X
					X	X
					X	X
					X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						2-week turnaround

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
John Skalbeck (1)		
RELINQUISHED BY: (Signature) Joseph A Bell (3)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) DATE/TIME	RECEIVED FOR LAB BY: (Signature) (2) Joseph A. Bell 3-20	DATE/TIME 16:00
METHOD OF SHIPMENT: NET COURIER		

Laboratory Copy White — Project Office Copy Yellow — Field or Office Copy Pink

(4) JSchwartz 3/20/90

6533

Harding Lawson Associates
200 Rush Landing Road
P.O. Box 6107
Novato, California 94948
415/892-0821
Telecopy: 415/892-1586

1228

CHAIN OF CUSTODY FORM

Lab: NET

Samplers: JOHN SKALBECK

Job Number: 4167,309.02

Name/Location: EXXON - Alameda

Project Manager: M. Watson

Recorder: John Skalbeck (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr Wk Seq	DATE: Yr Mo Dy Time	STATION DESCRIPTION/ NOTES
48			X		1			90 05 B0 10 2	90 03 19 0855	
			X		1			90 05 B0 10 5	0930	
			X		1			90 05 B0 10 6	0945	
			X		1			90 05 B0 20 2	1030	
			X		1			90 05 B0 20 4	1050	
			X		1			90 05 B0 30 1	1127	
			X		1			90 05 B0 30 2	1135	
			X		1			90 05 B0 40 1	1221	
			X		1			90 05 B0 40 2	1240	

ANALYSIS REQUESTED

EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb. (as Gasoline)
					X	X
					X	X
					X	X
					X	X
					X	X
					X	X
					X	X
					X	X
					X	X

LAB NUMBER: Yr Wk Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
				2-week turn around

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
John Skalbeck		
RELINQUISHED BY: (Signature) Joseph M. Bell	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) DATE/TIME	RECEIVED FOR LAB BY: (Signature) Joseph M. Bell 3-20	DATE/TIME 16:00
METHOD OF SHIPMENT: NET COURIER		

Laboratory Copy White | Project Office Copy Yellow | Field or Office Copy Pink

Schwartz 3/21/90

6533

Michelle Watson
Harding Lawson Associates
7655 Redwood Blvd.
PO Box 578
Novato, CA 94948

Date: 03-16-90
NET Client Acct No: 281
NET Pacific Log No: 1032
Received: 03-07-90 1540

Client Reference Information

EXXON, Alameda; Job: 04167,309.02

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

fax July
7 pages
3/16 11am

Enclosure(s)

Preliminary Report

Client Acct: 281
Client Name: Harding Lawson Associates
NET Log No: 1032

Date: 03-16-90
Page: xxx

Ref: EXXON, Alameda; Job: 04167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90100701 03-07-90 0910 48108	 90100702 03-07-90 1000 48109	Units
Title 22 Stuff		x	x	
GENERAL MINERAL ANALYSES	*			
Alkalinity, as CaCO3	-			
Total alkalinity	10	550	320	mg/L
Bicarbonate	10	550	320	mg/L
Carbonate	10	ND	ND	mg/L
Hydroxide	10	ND	ND	mg/L
Calcium	0.05	76	43	mg/L
Chloride	1	73	26	mg/L
Copper	0.005	ND	ND	mg/L
Foaming Agents (MBAS)	0.05			
Iron	0.02	10	11	mg/L
Magnesium	0.01	53	40	mg/L
Manganese	0.01	0.24	1.2	mg/L
pH (pH Units)	NA	7.0	6.9	pH units
Sodium (EPA 7770)	0.05	150	40	mg/L
Sulfate	1	97	5.3	mg/L
Conductivity (umhos/cm)	1	1,400	620	umhos/cm
Total Dissolved Solids	10	910	370	mg/L
Hardness, total (as CaCO3)	0.1	410	270	mg/L
Zinc	0.01	0.03	0.04	mg/L

Preliminary Report

NATIONAL ENVIRONMENTAL TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

Michelle Watson
Harding Lawson Associates
7655 Redwood Blvd.
PO Box 578
Novato, CA 94948

Date: 03-21-90
NET Client Acct No: 281
NET Pacific Log No: 1032
Received: 03-07-90 1540

Client Reference Information

EXXON, Alameda; Job: 04167,309.02

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

Enclosure(s)

Ref: EXXON, Alameda; Job: 04167,309.02

Parameter	Reporting Limit	Descriptor, Lab No. and Results 90100701 03-07-90 0910 48108	 90100702 03-07-90 1000 48109	Units
GENERAL MINERAL ANALYSES				
Alkalinity, as CaCO3				
Total alkalinity	10	550	320	mg/L
Bicarbonate	10	550	320	mg/L
Carbonate	10	ND	ND	mg/L
Hydroxide	10	ND	ND	mg/L
Calcium	0.05	76	43	mg/L
Chloride	1	73	26	mg/L
Copper	0.005	ND	ND	mg/L
Foaming Agents (MBAS)	0.05	ND	0.064	mg/L
Iron	0.02	10	11	mg/L
Magnesium	0.01	53	40	mg/L
Manganese	0.01	0.24	1.2	mg/L
pH (pH Units)	NA	7.0	6.9	pH units
Sodium (EPA 7770)	0.05	150	40	mg/L
Sulfate	1	97	5.3	mg/L
Conductivity (umhos/cm)	1	1,400	620	umhos/cm
Total Dissolved Solids	10	910	370	mg/L
Hardness, total (as CaCO3)	0.1	410	270	mg/L
Zinc	0.01	0.03	0.04	mg/L

Ref: EXXON, Alameda; Job: 04167,309.02

QUALITY CONTROL DATA - GENERAL CHEMISTRY AND INORGANICS

Parameter	Method	Blank	Spike Analysis (% Recovery)	Mean	RPD (%)	External Standard (% Recovery)	Method Standard (% Recovery)
Calcium	6010	<0.02	96	3400	20	105	105
Copper	6010	<0.02	80	3.1	3.3	96	88
Iron	6010	<0.02	88	5.8	1.7	93	95
Magnesium	6010	<0.05	93	3300	12	96	98
Manganese	6010	<0.02	82	13	1.5	92	98
Sodium	6010	<0.05	90	8500	15	110	102
Zinc	6010	<0.02	93	2.7	3.8	98	98
Total Alkalinity	310.1	<10	99	2300	<1	101	100
Chloride	300.0	<1	90	5.8	2.1	94	97
pH	150.1	N/A	N/A	9.4	<1	100	100
Sulfate	300.0	<1	98	7.2	1.9	100	99
Conductivity	120.1	<1	N/A	4,900	<1	96	97
Total Dissolved Solids	160.1	<10	N/A	540	9.3	102	100

KEY TO ABBREVIATIONS and METHOD REFERENCES

<	:	Less than; When appearing in results column indicates analyte not detected at the value following, which supercedes the listed reporting limit.
mean	:	Average; sum of measurements divided by number of measurements.
mg/Kg (ppm)	:	Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
mg/L	:	Concentration in units of milligrams of analyte per liter of sample.
mL/L/hr	:	Milliliters per liter per hour.
MPN/100 mL	:	Most probable number of bacteria per one hundred milliliters of sample.
N/A	:	Not applicable.
NA	:	Not analyzed.
ND	:	Not detected; the analyte concentration is less than applicable listed reporting limit.
NTU	:	Nephelometric turbidity units.
RPD	:	Relative percent difference, 100 [Value 1 - Value 2]/mean value.
SNA	:	Standard not available.
ug/Kg (ppb)	:	Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
ug/L	:	Concentration in units of micrograms of analyte per liter of sample.
umhos/cm	:	Micromhos per centimeter.

Method References

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

* Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated reporting limits by the dilution factor.

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Telecopy: 415/892-1586

CHAIN OF CUSTODY FORM

Lab: Net Pacific 1032

Samplers: David M Evans

Job Number: 04167,309,02

Name/Location: Exxon Alameda

Project Manager: Michelle Watson

Recorder: David M Evans (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES
23	X				3			90	10	07 01	90	03	07	0910	
23	X				3			90	10	07 02	90	03	07	1000	

ANALYSIS REQUESTED

EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb.	TDS	General Mineral
							X	X
							X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						ASAP - 2 day

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) David M Evans	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
DISPATCHED BY: (Signature) David M Evans — DATE/TIME 3-7-90 15:38	RECEIVED FOR LAB BY: (Signature) — DATE/TIME 3-7-90 1540	
METHOD OF SHIPMENT: Hand delivered in cooler w/ice		

Laboratory Copy White — Project Office Copy Yellow — Field or Office Copy Pink

6533

NATIONAL ENVIRONMENTAL TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

JAN 0 9 : 42

Michelle Watson
Harding Lawson Associates
7655 Redwood Blvd.
PO Box 578
Novato, CA 94948

Date: 01-22-90
NET Client Acct. No: 281
NET Pacific Log No: 9229
Received: 01-09-90 1230

Client Reference Information

EXXON, Alameda; Job # 4167,309.02

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

Enclosure(s)

SAMPLE DESCRIPTION: 90010901 01-09-90 1105
LAB Job No: (-43313)

Parameter	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS		--	
VOLATILE (WATER)		--	
DILUTION FACTOR *		1	
DATE ANALYZED		01-16-90	
as Gasoline	0.05	17	mg/L
METHOD 602		--	
Benzene	0.5	380	ug/L
Ethylbenzene	0.5	330	ug/L
Toluene	0.5	180	ug/L
Xylenes, total	0.5	1,300	ug/L

QUALITY CONTROL RESULTS - TOTAL PETROLEUM HYDROCARBONS (water)

Parameter	Reporting Limits	Units	Blank Results	Lab No. Spike and Spike Replicate Results (% Recovery) (-43705S)	(-43705SR)	RPD
as Gasoline	0.05	mg/L	ND	104	97	6.4
Benzene	0.5	ug/L	ND	97	95	1.9
Toluene	0.5	ug/L	ND	96	95	1.5

NET

NET Pacific, Inc.

KEY TO ABBREVIATIONS and METHOD REFERENCES

<	:	Less than; When appearing in results column indicates analyte not detected at the value following, which supercedes the listed reporting limit.
mean	:	Average; sum of measurements divided by number of measurements.
mg/Kg (ppm)	:	Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
mg/L	:	Concentration in units of milligrams of analyte per liter of sample.
mL/L/hr	:	Milliliters per liter per hour.
MPN/100 mL	:	Most probable number of bacteria per one hundred milliliters of sample.
N/A	:	Not applicable.
NA	:	Not analyzed.
ND	:	Not detected; the analyte concentration is less than applicable listed reporting limit.
NTU	:	Nephelometric turbidity units.
RPD	:	Relative percent difference, 100 [Value 1 - Value 2]/mean value.
SNA	:	Standard not available.
ug/Kg (ppb)	:	Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
ug/L	:	Concentration in units of micrograms of analyte per liter of sample.
umhos/cm	:	Micromhos per centimeter.

Method References

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

* Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated reporting limits by the dilution factor.

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CHAIN OF CUSTODY FORM

(9229) Lab: NetPacific

Samplers: David M Evans

Job Number: 4167,309.02

Name/Location: Exxon Alameda

Project Manager: Michelle Watson

Recorder: David M Evans
(Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	HCL	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES
23	X				3			3	90	01	0901	90	01	09	1105	

ANALYSIS REQUESTED

EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb.	TPH as gas/BTXE per NW 8015 mod
						X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						Regular turn-around time Please call Michelle Watson w/ result.

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) David M Evans	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
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NATIONAL ENVIRONMENTAL TESTING, INC.

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

JAN) 9: 52

Michelle Watson
Harding Lawson Associates
7655 Redwood Blvd.
PO Box 578
Novato, CA 94948

Date: 01-16-90
NET Client Acct. No: 281
NET Pacific Log No: 9198
Received: 01-05-90 1130

Client Reference Information

Project: EXXON, Alameda; Job # 04167,309.02

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

Enclosure(s)

SAMPLE DESCRIPTION: 90010401 01-04-90 0920
LAB Job No: (-43083)

Parameter	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS		--	
VOLATILE (SOIL)		--	
DILUTION FACTOR *		10	
DATE ANALYZED		01-12-90	
METHOD GC FID/5030		--	
as Gasoline	10	600	mg/Kg
METHOD 8020		--	
Benzene	25	1,700	ug/Kg
Ethylbenzene	25	10,000	ug/Kg
Toluene	25	3,200	ug/Kg
Xylenes, total	25	29,000	ug/Kg

QUALITY CONTROL RESULTS - TOTAL PETROLEUM HYDROCARBONS (soil)

Parameter	Reporting Limits	Units	Blank Results	Lab No. Spike and Spike Replicate Results (% Recovery) (-43237S)	(-43237SR)	RPD
as Gasoline	1.0	mg/Kg	ND	94	92	2
Benzene	25	ug/Kg	ND	98	94	4
Toluene	25	ug/Kg	ND	99	96	3

[redacted]
200 Rush Landing Road
P.O. Box 6107
Novato, California 94948
415/892-0821
Telecopy: 415/892-1586

9198

CHAIN OF CUSTODY FORM

Lab: NET

Samplers: S. MICHELLE WATSON

Job Number: 04167.309.02

Name/Location: EXXON ALAMEDA

Project Manager: MWatson

Recorder: S Michelle Watson
(Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED: EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pllnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb. GAS
SO			X		1			90	01	0401	90	01	04	0920							X	X
SO			X		1			90	01	0402	90	01	04	0930	HOLD							
SO			X		1			90	01	0403	90	01	04	0945	HOLD							
SO			X		1			90	01	0404	90	01	04	1000	HOLD							
SO			X		1			90	01	0405	90	01	04	1010	HOLD							
SO			X		1			90	01	0406	90	01	04	1020	HOLD							
SO			X		1			90	01	0407	90	01	04	1040	HOLD							

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						2 week turn around
						rec'd on ice 1/15

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) S Michelle Watson	RECEIVED BY: (Signature) Sharyl Ford	DATE/TIME 1-690 11°Am
RELINQUISHED BY: (Signature) Sharyl Ford	RECEIVED BY: (Signature)	DATE/TIME
RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
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Novato, California 94948
415/892-0821
Telecopy: 415/892-1586

CHAIN OF CUSTODY FORM

Lab: NET

Samplers: S. MICHELLE WATSON

Job Number: 04167.309.02

Name/Location: EXXON ALAMEDA

Project Manager: MWatson

Recorder: S Michelle Watson (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr Wk Seq	DATE: Yr Mo Dy Time	STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED: EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	Priority Pltnt. Metals	Benzene/Toluene/Xylene	Total Petrol. Hydrocarb. GAS
SO			X		1			900104001	900104 0920	5.5-6.0						X	X
SO			X		1			900104002	900104 0930	HOLD 11.0-11.5							
SO			X		1			900104003	900104 0945	HOLD 16.0-16.5							
SO			X		1			900104004	900104 1000	HOLD 21.0-21.5							
SO			X		1			900104005	900104 1010	HOLD 26.0-26.5							
SO			X		1			900104006	900104 1020	HOLD 31.0-31.5							
SO			X		1			900104007	900104 1040	HOLD 36.0-36.5							

LAB NUMBER: Yr Wk Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
				2 week turn around

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature) S Michelle Watson	RECEIVED BY: (Signature) [illegible]	DATE/TIME 1-6-90 11[illegible]
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METHOD OF SHIPMENT		

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PHASE III EVALUATION OF PETROLEUM HYDROCARBONS
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1725 PARK STREET
ALAMEDA, CALIFORNIA

May 1, 1990

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QUALITY CONTROL REVIEWER

Michael L. Siembieda
Associate Geologist - RG 4007